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INTRODUCING PEER-ASSISTED LEARNING CONCEPT IN A DESIGN COURSE

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ABSTRACT
Design education is based on interactive discussions between students and their facilitators. Deeper engaging interactions can generate a range of concepts in the initial design phase. However, from the student's perspective, the discussions with the course facilitator may turn formal and pose a restriction on free-flowing ideas. Despite applying different student engaging methods, there still seems to be an invisible barrier that holds them back from freely expressing their design thoughts. The concept of Peer-Assisted Learning (PAL) was introduced in a design course in the Department of Design at the Indian Institute of Technology, Guwahati (DoD, IITG), to solve this issue. This paper discusses the observations and findings of the experimental study with PAL in an industrial design course for concept generation. Conceptual solutions were developed for different design problems as part of the design charrette planned within the course. The final year Masters in Design students mentored junior students from third-year Bachelors in Design in the design charrette under the course instructors' guidance. This exercise helped the junior design students quickly open up with their mentors and share their ideas smoothly. The senior students acted as a catalyst in generating a range of possible outcomes in a short period. A survey conducted at the end of this course with the junior students showed that the students accepted PAL well and would like it to be part of other courses in the future. Therefore, this paper recommends introducing PAL in design education as it effectively develops professionalism in senior students and helps the junior students use their seniors' experiences. Additionally, it imbibes a sense of community learning in the student group.

Keywords: Peer Assisted Learning in design education, community learning, concept generation

1 INTRODUCTION
The many concepts generated in the early design phase are crucial for any design innovation [1]. However, design students usually struggle to explore the problem space and fix the concept in the initial stages. Furthermore, it is observed that junior design students have apprehension in expressing their ideas to senior faculty members within the formal structure of design education. Thus, to overcome this hurdle, Peer Assisted Learning (PAL) was introduced in an industrial design course on an experimental basis. In this experiment, final-year Masters in Design students (peer tutors) engaged with third-year Bachelors in Design students (peer tutees) to guide them in their concept generation process. PAL has a vital conceptual share of most medical education [2]. However, no known evidence of it being implemented in a formal design course is found. This paper discusses the influence of PAL as an innovative method for concept generation in junior grade students.

2 AIM AND OBJECTIVE
Since PAL was borrowed from a different domain of practice, it is thus necessary to assess the impact and perception of the developed method in practice. Furthermore, the research aims to inspect PAL's performance during the concept generation stage and understand students' perceptions of implementing it as a formal teaching method. Therefore, under the supervision of the course instructor, PAL was introduced in a 5-day online product design elective course at the DoD IITG. A quantitative survey was conducted with peer tutees to record their experiences at the end of the course.

3 PEER ASSISTED LEARNING (PAL)

Peer-assisted learning acquires information and ability through active helping and supporting others [2]. The participants are not professional tutors but are committed to helping each other learn & grow. PAL is beyond teaching and learning, and the students involved imbibe the role of facilitators and develop a sense of concern [2]. Boud and Cohen (2014) defined peer learning as *"the use of teaching and learning strategies in which students learn with and from each other without the immediate intervention of a teacher"* (p.2). The following factors can be considered critical for a successful PAL session - 1) educational distance between peer tutor and peer tutee, 2) form of teaching and setting, and 3) size of learner group [2]. Despite peer tutors being more senior, they behave more like facilitators & mediators, creating an environment of cooperative learning and guiding the peer tutees through active learning [2]. The peer tutors assist new students in making the transition from school to university and help them adjust to the new lifestyle as they have a go-to person to ask any questions. PAL is mutually beneficial for student tutors and student learners [7]. They guide the peer tutees in resolving issues through dialogue, boosting self-esteem, encouraging the use of Helpdesks or other resources, and advising them on contacting programme directors or careers counsellors if the course was not fit for them [4]. PAL allows students to explore new concepts comfortably in a less formal academic environment. It helps students develop self-awareness, critical reflection, and openness to feedback. The peer tutors aided them by providing problem-solving tactics, encouraging them to support each other, recommending time management strategies, and simply being another face on campus to recognize. They are helpful and more easily approachable and offer straightforward explanations and practical examples, which further aided in developing a "deeper understanding." They further encourage group interaction and discussions. As per a previous study, students who did not participate in PAL accounted for the majority of course withdrawals. The students who were a part of PAL showed relatively high attendance [4].

4 EXPERIMENTAL APPROACHES

4.1 Research Questions

This study seeks to understand the effect of the PAL method in Design Education on generating novel concepts by peer tutees in a tangible product design course and aims to answer the following research questions:

1) Does using the PAL method result in more innovative concept generation?
2) How do peer tutees perceive PAL in use?

4.2 Participants

Eighteen third-year Bachelors in Design students participated in the experiment under the elective Industrial Design course. In addition, a group of 6 final-year Masters in Design students mentored the peer tutees under the supervision of one course instructor in an online method of teaching. The peer tutees were divided into teams of 6 with three members each.

4.3 Method

This experimental study was conducted under the supervision of the course instructor in a longitudinal research approach and spread over four phases. This approach helped establish a comparison in the results and affirm the positive effect of the treatment. The four phases were concept generation without the PAL method, planning phase (within peer tutors), execution phase (with PAL method), and the last phase was the survey phase, as illustrated in Figure 1. Phase I began by asking the students to generate novel concepts without the PAL method. In phase II, the peer tutees were given a short presentation by the peer tutors explaining the broader scope of 6 different topics. The peer tutees were then divided into six groups of 3 students, each based on their 1) Preferences of topics, 2) 3D modelling & presentation skills, and 3) Physical prototyping skills to form a balanced team. At the beginning of phase III, each team met online. The peer tutees initiated an informal onboarding session and explained the sequence of activities planned for the course. Each team followed a different modus operandi for conducting the design charrette. Some shared resource materials with students, others started by asking curious questions, and a few other teams began with group activities. Based on the design brief, the scope of the project and final deliverables were mutually decided by the tutees and the tutors. After identifying the problem areas, the students dived into ideation and concept generation. After multiple rapid brainstorming sessions, each team developed novel concepts ranging from 5 to 20 ideas, depending on

the complexity of the topic. The peer tutors periodically updated the progress of each team to the course instructor and gathered feedback. To shortlist the final concept, each team decided to vote based on the following parameters – 1) Effectiveness, 2) Quantity, 3) Quality, and 4) Novelty [5][6]. The final concept was further developed based on the inputs shared by the tutors and presented towards the end of the 5th day. At the end of the presentations in phase IV, an online survey was conducted with the tutees to understand their learning experience and acceptance of the PAL method.

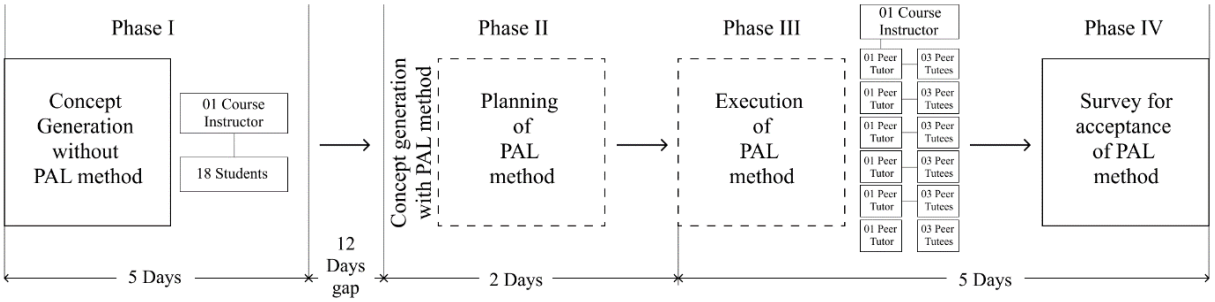

Figure 1. Experiment execution diagram

4.4 Sequence of activities

In phase III of the execution phase, each of the six peer tutors had their process of mentoring the tutee, which is explained below:

Team A- Topic: Design for Playful Furniture, Design brief: Find ways to design playful furniture and create playful furniture using them. On day one, the students were asked to define and understand playfulness as an ice-breaker activity. The next task was broken into three actions - making task lists, documenting playful activities, and grouping them. Day two comprised changing the context of products by adding playfulness to them. With the obtained data on day three, brainstorming sessions were conducted to generate multiple concepts. The concepts were shortlisted for further detailing. The last two days included developing a CAD model, scaled prototypes, and the final presentation.

Team B- Topic: Design for Traditional Toys, Design brief: To design traditional toys for imparting knowledge to kids. As an ice-breaker session, the team was engaged in casual conversation on day one. The tutees and the tutor then moved to identify comparable products in the market. Tutees were asked to brainstorm to generate multiple concepts based on days two and three data. In the last two days, the concept detailing and development of CAD models was concluded with the final presentation.

Team C- Topic: Construction Toys, Design brief: To design and develop construction toys for kids. On day one, the tutees were engaged in social games of finding answers with relevant keywords. The second day was dedicated to extracting the keywords deduced from the previous day. The third day's activity was to design a unit with the Kaizen technique*. On day four, the tutees were asked to develop multiple units using a similar method before the final refinement and detailing. On the last day, the tutees presented two of their best concepts.

Team D- Topic: Tech-induced learning toys, Design brief: To develop technology-induced design learning toys for kids. On day one, the tutees were engaged in an informal question-and-answer session to define the topic briefly. Later the same day, activities such as gathering ideas from the surroundings and making a list of comparable tech products were conducted. The ideation stage spanned over two days, generated multiple novel ideas, and filtered them. The final concept was further detailed for CAD modelling on the fourth day. The concepts were presented on the last day.

Team E- Topic: Musical instruments for Kids, Design brief: To design self-intuitive musical instruments for kids. The tutor conducted a small question-and-answer session as an ice-breaker on the first day. The next day's activities included creating and identifying conventional sound generation techniques. Tutees were asked to develop their concepts and combine them to form a final concept on the third day based on the data. The fourth and fifth days were assigned for product detailing, prototyping and presentation.

Team F- Topic: Future of Wearables, Design brief: To design healthcare wearable devices for kids. The topic was introduced to the tutees on day one, and resource materials were shared. This was followed by different mapping and understanding activities. Multiple brainstorming sessions were conducted on days two and three to define design parameters and generate novel concepts. Concept detailing was done on the fourth and fifth days, then CAD modelling and a final presentation.

In phase IV, the tutees were asked to respond to the following questions to understand their overall experience and perception of the PAL method.

Table 1. Questions submitted to the students

Q#	Text of Questions	Scale
Q1	Rate your experience of learning with peer tutors.	(Average to Excellent)
Q2	Rate your experience of the following [Discussion with senior mates]	(Average to Excellent)
Q3	Rate your experience of the following [Design thinking]	(Average to Excellent)
Q4	Rate your experience of the following [Task flow]	(Average to Excellent)
Q5	Rate your experience of the following [Overall outcome]	(Average to Excellent)
Q6	Would you like to opt for the PAL in the future in other courses?	(Yes/No)

5 RESULT & DISCUSSIONS

5.1 Major Findings from Phase I

In phase I, the peer tutors had to generate novel concepts with the conventional pedagogy without the PAL method. The concepts generated without any mentorship of senior students have the following issues: 1) low count of concepts generated, 2) lack of novelty, 3) deficiency in technical skills, and 4) lack of clarity. The peer tutees lacked practical exposure and a holistic approach to problem-solving. Such a situation necessitates a scaffolding system to facilitate novice students' creative concept generation. Some of the examples of concept generation are shown in Figure 2.

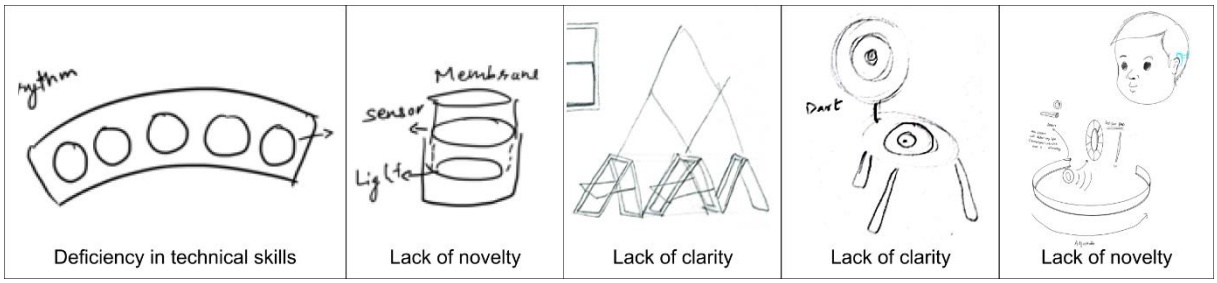

Figure 2. Concept sketches from phase I

5.2 Major Findings from Phase II

Based on the response from the peer tutees, it was observed that a few topics were more preferred over others.

5.3 Major Findings from Phase III

An important finding from the execution phase was that the number of concepts generated increased instead of phase I. The concepts in phase III were substantially improved as they showed a better understanding of problem-solving and enhanced cognizance of technology. It was also found that the preferences of topics solely did not influence the performance of the tutees. The mentorship from phase III also helped in the overall concept presentation—a few examples of concepts generated with the PAL method, as shown in Figure 3.

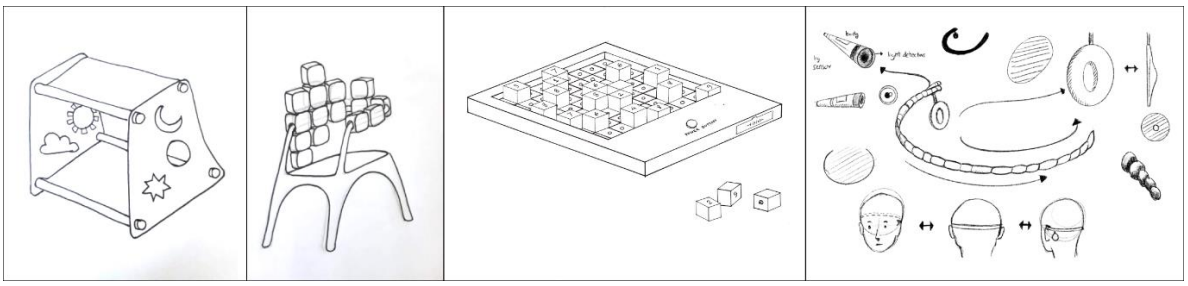

Figure 3. Concept sketches from phase III

5.4 Major Findings from Phase IV

The survey response shows a positive outlook from the tutees towards PAL with senior peer tutors as it helped in boosting their confidence. The survey shows that the overall course could have been more structured and detailed. However, it was observed that the online mode of conduct and shorter course timeframe proved to be detrimental to the overall experience of a few students as the scope for tangible explorations was limited. The responses to the survey are visually summarized in Figure 4.

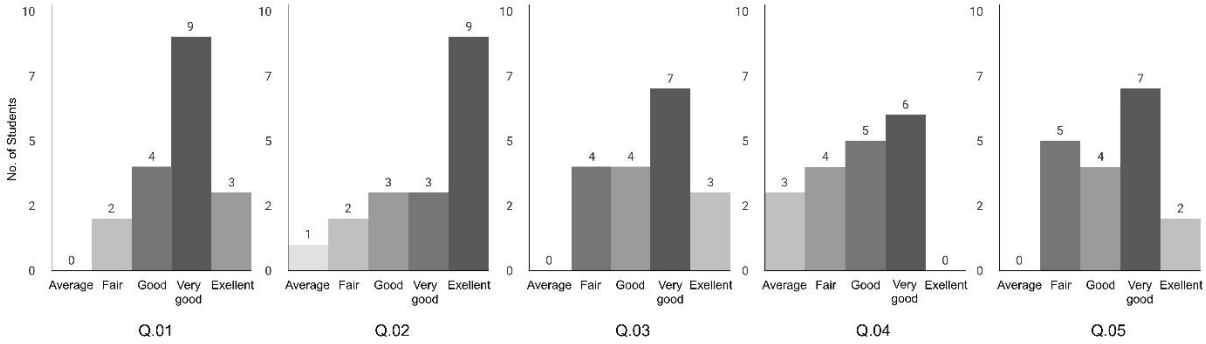

Figure 4. Responses of the participants

Based on the response to Q6 in Table 1, it was found that 100% of the students would like to opt for the PAL method in other courses. They also appreciated the experimental and unconventional approach to the study. It was also observed that novice designers lack the exposure and capacity to absorb complex theoretical concepts. Thus, technology-based or complex concept-driven projects need more time and interactions for better explorations of solutions.

6 RECOMMENDATIONS

This experiment of introducing PAL to third-year design students shows that this method helps to generate diverse and novel design concepts. This study shows a strong inclination of tutees toward interacting with their senior students and using their experience to develop a holistic understanding of the design process. Thus, this paper recommends conducting further research in a more extensive setup for formally introducing PAL in a product design course. A similar study should be conducted offline with a larger sample group to assert the positive impacts of the method further.

7 CONCLUSIONS

This paper discusses the impact of the PAL method on novice designers while introducing it in an elective course setting. Observations from phase I indicate the necessity of a guidance system to stimulate the creative output of design students to generate novel and diverse concepts. The survey phase shows a positive perception of this method. Seniors' expertise aids peer tutees in rapid exploration and novel concept generation. It was observed that the PAL method mitigates the inhibitions towards senior faculties, which could hamper the innovation process. Although this experiment was carried out for an industrial design course, it might be replicated in other design domains to see if the outcomes are comparable. Such research could contribute to the PAL method's formal recognition in design education.

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