

Building Students' Learning Habits on Slack: An Application of the IDC Theory

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Abstract: The integration of ubiquitous technologies with classroom interactions has the potential to foster positive learning habits in students. The instructors at Educational Technology Program in IIT Bombay tackled the challenge of remote learning during the COVID-19 lockdown by conceptualizing the use of the Slack platform to promote learning habits among their graduate students. Grounded in the IDC theory specifically developed for the Asian population, the design of this pedagogical intervention aimed to promote students' habit of conveying complex ideas in an accessible manner through two learning activities aligned with their interests. Conversation analysis was used to examine instructors' actions to develop learning habits in students, and member check interviews were conducted with instructors to verify the pedagogical approach and findings. The study demonstrated how the instructors' pedagogical intervention on the Slack platform supported the development of learning habits among graduate students. The results exhibited the mapping of individual components of the habit loop, i.e., cuing, routine and harmony with the design and outcome of the approach. Students' satisfaction with routine activities and impatience for creations from the learning activities indicated harmony which eventually leads to habit formation. The continual pursuit of learning activities without instructor involvement also suggested habit activation. The present study contributes to the current understanding of effective pedagogical practices to foster good learning habits by leveraging ubiquitous learning tools.

Keywords: Learning habits, ubiquitous learning tools, Slack platform, IDC theory, habit loop, interest-driven learning activities, graduate students

1. Introduction

Developing good learning habits is crucial for students to become lifelong learners and acquire essential competencies for the 21st century, such as critical thinking, self-regulated learning, problem-solving, and collaborative skills (Chan et al., 2018). Hence, educational institutions must prioritize these competencies to foster students' professional growth by promoting the cultivation of good learning habits.

The Educational Technology (ET) Program at IIT Bombay in India encompasses Masters and PhD students, postdoctoral scholars, academic staff and faculty members. During the COVID-19 lockdown, the instructors in the ET Program at IIT Bombay faced the challenge of enhancing learning without the ability for physical interactions. It was during this time that the instructors conceived the idea of using Slack, a ubiquitous learning tool supported by mobile and computers, to connect the team and promote learning. They recognized the potential of this cloud-based instant messaging platform (Slack Technologies, Inc., n.d.) to foster good learning habits among the PhD and MTech students. Slack is designed for team communication and collaboration, offering real-time channels, direct messages, and calls. It also integrates a range of productivity and collaboration tools (Montrief et al., 2021), making it a versatile platform for remote learning.

The pedagogical design of this intervention was grounded in the interest-driven creator (IDC) theory which was specifically developed in the context of the Asian population (Chan et al., 2018). The Asian education system and curriculum drives students to the habit of rote learning and achieving academic satisfaction with high scores in grade-level exams

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(Chan et al. 2018; Kirkpatrick & Zang 2011). Forming interest-driven or skill-based habits of learning to promote professional growth of students have not been sufficiently considered in formal education. Hence, the instructors in this study applied the IDC theory to encourage positive learning habits among their graduate student community utilising the Slack platform. They achieved this by incorporating creative activities that aligned with students' interests into their daily learning routines. The Slack platform was pivotal in cultivating these habits in students among a diverse team of individuals. With the aid of valuable feedback from both instructors and peers, the platform facilitated increased engagement and led to marked improvements in creative idea generation and effective communication of complex information.

This study aims to demonstrate how Slack, as a ubiquitous learning tool, can be used to promote positive learning habits in an academic context. The learning activities were designed to develop the habit of conveying complex information in an accessible manner. Specifically, these activities, entailing the creation and sharing of newsletters and memes, involved fostering critical thinking abilities to break down complex concepts and ideas into simpler, more manageable parts that can be easily understood by different audiences. Hereby, we present a pedagogical approach for promoting learning habits among students on Slack by implementing the IDC theory. This contributes to the existing knowledge of effective educational practices with ubiquitous learning tools.

2. Literature Review

2.1 Interest-Driven Creator Theory

The IDC theory consists of three anchored concepts: interest, creation and habit which are interconnected in various ways (Chan et al., 2018). The theory assumes that learners, when driven by interest, can be engaged in knowledge creation, and the repetition of such processes in their daily learning routines will help in forming interest-driven creation habits for them.

The concept of habit formation is an integral component of the IDC theory. The habit loop suggests that habits are formed through a three-step process: *cuing environment* (arrangement of place, time, people, or incidents), *routine* (repetitive pattern of activities), and *harmony* (Chen et al., 2020). The theory posits that learning activities can be developed as interest-driven creation activities through a rigorous design process that prioritizes the cultivation of students' interests. The creation activities must be sufficient to arouse curiosity, engage students in the activities, and extend the scope of those activities in the pursuit of personal interests. To ensure that these activities have lasting effects, the study proposes that they should be incorporated into the daily routine so that students can develop a habit of learning through daily engagement with these activities.

Several researchers have employed the IDC theory as a guiding framework to design learning activities and curriculum in computer programming education (Kong et al., 2018; Kong & Li, 2016) and mathematics course (Huang et al., 2020). A recent study highlighted the implementation of an IDC experimental school in nurturing teachers' pedagogical practices and encouraging academic growth in students (Looi et al., 2023). An example of an IDC-based learning activity intervention focused on habit development is the Modeled Sustained Silent Reading (MSSR) (Wong et al., 2020). The main objective of MSSR was to assist students in developing a reading habit. The intervention involved exposing students to a "modeled" and "silent" environment repeatedly. Another recent study designed learning activities using the IDC theory for students to develop an interest in podcast English learning, be immersed in the learning process and, by repeating this process in their daily routines, strengthen learning habits (Chen et al., 2022). The findings provided useful insights for podcasters to invest in establishing learners' interest factor and stimulating experiences to improve their continuous learning intention. While the IDC theory has been utilized in various applications that focus on interest and creation loops (Huang et al., 2020; Kong et

al., 2019; Wong & Wong, 2020), there has been a lack of attention to the habit loop aspect of the theory.

2.2 Habit Formation in Academia Using Ubiquitous Learning Tools

Instilling good learning habits in students is highly valued by teachers and parents for their long-term learning and development, as they significantly impact academic achievements and future success (Chan et al., 2018; Ebele & Olofu, 2017). A habit is a pattern of behavior that is repeated regularly and often happens unconsciously. In the context of this study, habit is used to refer to mental processes which become evident as behavioural inclinations when students are continuously interacting with tasks or actions of interest-driven learning (Chen et al., 2020).

Though there is enough research on the role of ubiquitous learning tools, including social media in academia (Aljawarneh, 2020; Dontre, 2021), there is a lack of empirical evidence on the correlation between these learning tools and academic habit formation. Slack is a ubiquitous learning tool predominantly geared towards professional use in businesses and organisations. A recent study investigated the use of Slack as a communication platform to enhance collaborative learning and online activities in online and flexible programming courses for in-service teachers (Rouhani, 2020). The results indicated Slack as one of the factors that possibly contributed to increased activity and learning in the course, specifically through the role of instantaneous feedback and discussions. Though Slack is regularly used by students and educators in higher education for team communication and collaborative learning (Menzie & Zarb, 2020; Ross, 2019), there is a gap in the research that explores the potential use of the platform for fostering habit development. Additionally, none of the previous studies have applied the IDC theory in academic contexts through ubiquitous and collaborative learning tools to develop learning habits.

The instructors in the ET Program at IIT Bombay hypothesized that if students' curiosity, creativity and routine was stimulated on the Slack platform, they were likely to acquire good learning habits and evolve into enthusiastic creators. In this approach, the instructors aimed to foster habits of conveying complex and creative ideas in an accessible manner among their graduate students. To achieve this goal, utilising the Slack platform, the instructors integrated learning activities that were aligned with students' pre-existing interests into their daily learning routines. The instructors methodologically harnessed the habit loop components of the IDC theory by finding the right triggers as cues for starting the habit, following a routine and providing repeated tasks with small goals to students, and examining the outcomes of these activities.

3. Pedagogical Design

3.1 Learning Activities

Utilizing the Slack platform as a ubiquitous learning tool, the pedagogical design of this intervention was based on the habit loop components of the IDC theory. As part of this intervention, the instructors created two specific learning activities to develop the habit of conveying complex ideas and concepts in an accessible manner.

Learning activity 1: For this learning activity, the instructors tapped on the known interest of their students, i.e., to communicate with each other through social media. In March 2020, an email was received by all PhD and MTech students of the department to engage in the creation and sharing of a daily ET Newsletter on Slack platform. In terms of content creation of these newsletters, the activity was open to include academic and non-academic issues as well as students' personal experiences. Since this activity was conducted in the period of COVID lockdown, it prompted a multitude of articles with creative and diverse insights from the team members dispersed across the country. On Slack, the

newsletters served as an opportunity to showcase students' ideas, creating a sense of community and collaboration within the team. The articles comprised diverse sections of entertainment including research, fiction, philosophy, cartoons, creativity corner, health, travel, etc. The key goal of this activity was to cultivate the habit of communicating intricate and innovative concepts in a way that is easily understood by a wide cohort. The purpose of fostering this habit was to enable individuals to deconstruct complex ideas or concepts into simpler and understandable terms which can be consumed by a wider audience. This is an extremely important habit in the field of academia which can help individuals become effective communicators and improve their ability to connect with others.

Learning activity 2: In the second learning activity, instructors fostered students' pursuit to create memes as a voluntary activity. Meme creation and sharing was an activity of interest to students which was carried out by them on their personal chat groups. This was noticed by instructors in an informal discussion, after which the students were asked to start sharing these memes on the Slack platform with all team members. Furthermore, an instructor incorporated the idea of EdTech memes activity as a regular practice associated with assessments for his courses, namely *Human Computer Interactions* and *Learning Sciences*. As part of the assessment, students were given specific guidelines for creating memes related to each course element, and they were required to upload their creative outputs on Slack. To create an effective meme, students must extract complex ideas into a brief message and present it in a way that is easily understandable and engaging. This requires not only creativity but also critical thinking skills to convey and determine how best to present it. Through memes creation, the instructors aimed at developing the habit of conveying complex ideas in an accessible and engaging way, which can be a valuable skill in many personal and professional contexts.

3.2 Instructor Actions

The intervention focused on nurturing students' interests, fostering opportunities for meaningful creation and supporting the development of good habits on the Slack platform. Hence, the instructors' actions involved in this approach were categorized into three primary components, namely tapping creative interests of students, creation of learning activities and motivating students to not only initiate but also maintain engagement in learning activities until they become habitual (Fig. 1).

Instructors tailored creation-based learning activities to student interests and context, thereby aiding them in overcoming their initial resistance to building a new habit. Student interests were identified through informal conversations (on Slack or in person) and classroom observations, which was a continuous and implicit effort by the instructors (Fig. 1). Additional design characteristics were employed to facilitate the cognitive engagement of students with the learning activities. These features included creating a focused question to guide the learning activity, developing activities which were relevant, required critical examination, and were open to diverse and valid perspectives.

After posting the learning activities and creating dedicated channels on Slack, the instructors dedicated their efforts towards inspiring and motivating the students to sustain their engagement in the tasks. By sharing detailed written guidelines, instructors ensured that the purpose of the learning activity was clear to the students before the start of the activity which made it goal-directed.

Modelling of learning activities by instructors is crucial to habit development due to the nature of humans (Chan et al., 2018). The instructors modeled their own creations on Slack showing a clear example of how the task and skill should be performed. This helped the students get a better understanding of the expected outcome. Also, when the students witness the instructor getting involved in the learning activity, they are more likely to become motivated to do the same, which enhances their focus and engagement in the task.

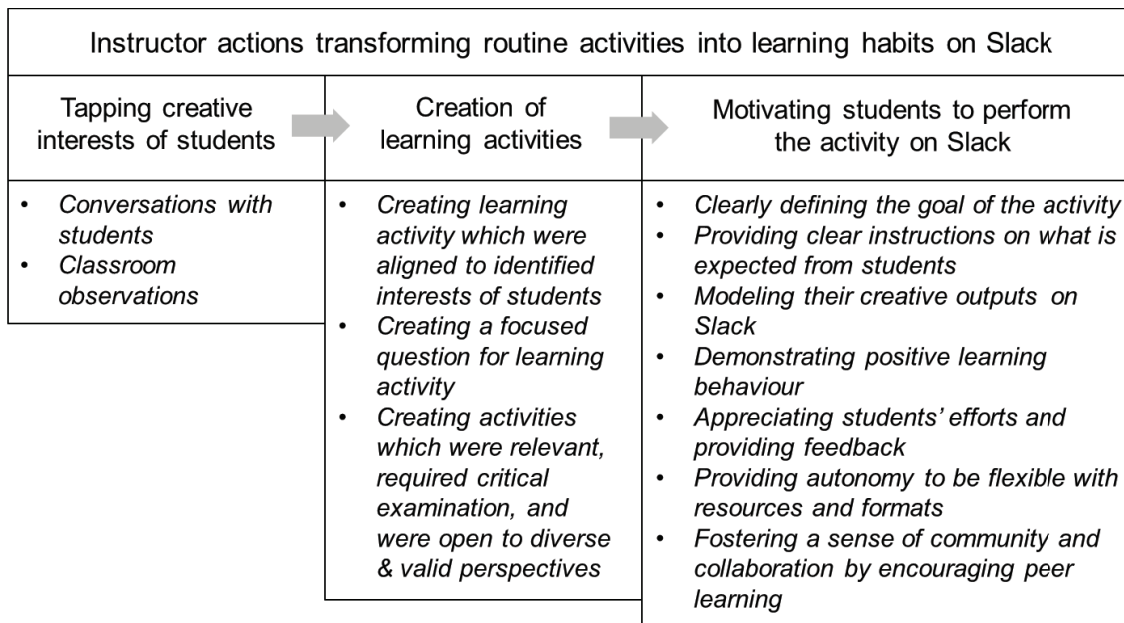


Figure 1. The figure illustrates the instructors' pedagogical design categorized into three primary components.

Furthermore, the instructors often demonstrated positive learning behaviour by recognizing the new knowledge gained from other students and providing feedback on their creation. Here, this aspect holds significant importance as these activities foster the development of habits by combining self-practice along with learning from the strengths and weaknesses of others. Instructors also motivated the students through constructive feedback on each creation.

As the process of habit development for complex tasks is an interplay between one's agency and situational resources (Chen et al., 2020), the instructors ensured that the students were not restricted in their creativity due to technological access or any other constraints. Students were provided with the autonomy to use simplest resources or complex tools to come up with their products. The following excerpt from an instruction provided to students, for learning activity 1, on the Slack platform was an example of such creative freedom: *"Good morning all. Thank you all for your contributions in all aspects. For the future broadcasters here is a small reflection: Do it the way you want to and are interested in doing it. The most important part is to have fun and enjoy doing this. It's not necessary to follow any format. Make your own format and try to involve as many people as possible. They may not be able to give you exactly what you want but that is ok they have their own challenges. Take what you get and use your freedom to create anything you like. Most importantly, have fun."*

The instructors chose the Slack platform to facilitate these learning activities and foster a culture of sharing among the students. By encouraging them to share their work with peers, a sense of community and collaboration was created, which served as another motivating factor for the students to perform the tasks diligently and receive feedback.

4. Methodology

4.1 Research Question

While the link between habits and learning is widely recognized, there is much less research that investigates how learning habits are formed in various circumstances using ubiquitous learning tools. The aim of this study was to explore the development of learning habits among students on Slack using the IDC theory. Hence, the following research question was

investigated in this study: *How does the instructors' pedagogical design, based on the habit loop of the IDC theory, support the development of learning habits on the Slack platform?*

4.2 Participants

The learning activities were offered on the Slack platform to foster learning habits among PhD and MTech students of the ET Program at IIT Bombay. However, these learning activities were also participated by other team members and the alumni community. For the learning activity 1, there were a total of 5 instructors, 30 students, 12 alumni and 10 academic staff members who participated on the Slack platform through creation activities and feedback mechanisms. However, for the learning activity 2, there were 5 instructors, 51 students, 8 alumni and 2 staff members as participants.

4.3 Data Sources and Data Analysis

The data source of this research came from the time-stamped chat logs of Slack, which was created for the team members of the ET Program in 2018. Instructors often initiated casual conversations on different Slack channels to keep the students connected and motivated. In March 2020, the pedagogical approach, based on the IDC theory, was utilised on two new Slack channels named *newsletter_et* and *et_memes*. The chat logs were downloaded from these channels, and organised chronologically along with relevant documents, images and other media shared within the Slack workspace. The number of posts and threads related to the learning activities on Slack were quantified and presented in the results section.

The chats on each channel were screened to filter the threads showing evidence for different components of the habit loop and instructor actions. Conversation analysis (Meredith, 2019) was used to analyse the participation of instructors and students in the conversations and study the structure and specific aspects of these discussions, including instructor and peer involvement, quality of discussions, frequency of feedback, etc. Patterns were examined in the data to find relevant evidence for the research question, involving linguistic resources such as use of word choices, sentence structure and language, emoticons, and team members' responses. Analysis and patterns were used to map the instructors' actions aimed at transforming routine activities into learning habits of conveying complex ideas in simple ways. Additionally, member check interviews were conducted with two of the instructors who played significant roles in the design and conduct of these learning activities. Member check was performed to provide any corrections, clarifications, or additional insights on the pedagogical approach and its relation to the findings.

5. Results

The habit loop of the IDC theory, consisting of cuing environment, routine and harmony was used as the framework to design the pedagogy for these activities. The learning activities chosen in the pedagogical intervention were focused to promote the habit of conveying complex ideas and concepts in a way that is easily understood by a wide cohort. Herein, we analyse the interplay of habit loop components of the IDC theory in building this learning habit among the graduate students employing the Slack platform.

5.1 Cuing Environment

In order to encourage students to start with creative activities without hesitation, a cuing environment should be provided (Chen et al., 2020). For both learning activities, there were three primary context cues that were utilised: a) friendly and social environment of Slack, open to team members, which can spark interest in such creations (Fig. 2a), b) the instructors who modeled such interest-driven creation activities and insightful discussions which could be mimicked by the students (Fig. 2b), and c) constructive feedback provided by

instructors and peers which helped students gain perception and motivated them to excel (Fig. 2c).

<p>*Thread Reply:* Very innovative and fun GJ 😊 Well done. I'm very happy to see the creative side of the first years as I haven't interacted with them much. Great going all! 🍌</p> <p>*Thread Reply:* Very well done GJ.... I'm overwhelmed.... Enjoyed reading the extension of the ESRO series. Loved your creativity. The last line, "thinking of how to get the avengers and children in one frame" is deep (remotivates our outreach goals.) Enjoyed all of</p>	a
<p>Newspaper_ET - Volume 2</p> <p>NewspaperET is a publication of the ET group, which also owns RadioET, TVET, PodcastET, BlogET, and any other form of broadcast imaginable. NewspaperET is online-only. You will never see delivery people lugging huge stacks of this paper around. Special Edition - 22-March-2020</p> <p>[Due to today's curfew, we expect a huge demand for our paper. To save your network bandwidth while reading, we have thrown away all formatting and bring you this lite edition. We have drawn a few lines here and there to help you visualize the formatting.]</p> <p>Page 1, column 1 - Murder Mystery (This is a true story but the names of all characters are changed to protect their identity. We have referred to them only by their initials - SI) Pandemonium reigned yesterday in the offices of Radio_ET. RJ-Moz was missing. The coffee cup was there, the half-eaten pizza slice was there, but no RJ-Moz. There was a suspicious looking big red stain on RJ-Moz's chair. Station Manager RP did not waste any time in calling in KA and AD, the famous hypothetico-detectives. (Read their previous case https://www.cse.iitb.ac.in/~sri/papers/hdr-icce2015.pdf here) KA hacked into RJ-Moz's computer, while AD examined the scene. KA found that RJ-Moz had been checking out videos from a site called ETMantra. She also noticed that there was an email offer of making quick money. Thirdly, RJ-Moz had enrolled in a few online courses but never completed any. At the other end of the room, AD cautiously tasted the red stain and exclaimed "Arre, yeh tho ketchup hai". What else did you expect? Then he found a piece of paper with the words "stand-up comedy" written on it.</p>	b
<p>*Thread Reply:* @Narasimha some thoughts -</p> <p>1 I am beginning to like the section - Philosopher's answer to researcher's dilemma. Aptly titled. At the end of today's section I particularly liked how the section closed with the lines 'essence of _ by interconnecting both quality & quantity'</p> <p>2. Clarification question on the On Cultural Nature of Human Development by Barbara Rogoff What do you mean by zoological model of education? How do you compare it with computational model? How is it related to your focus question ?</p> <p>3. Clarification question on Countercurrents How is the term refugee differ from migrant? I think it is important to carefully use these terms. IMHO, I think migrant is the right term to be used for people moving within the country. But it is important to adapt the term suitably in the local language like how in Kerala they have started using the term 'Atithi thozhilalikal' (guest labourers)</p>	c

Figure 2: Primary context cues for learning activities: a) friendly Slack platform among team members b) instructor modeling for interest-driven creation activities, and c) constructive feedback from team members.

The possibility of using a ubiquitous technology in sharing such creative outputs also acts as a trigger in this context. On Slack, students were able to share their creations horizontally in a safe environment with peers and also vertically across different professional cohorts, including faculty, alumni and different years of PhD and MTech students. Feedback and discussions on these creations were rich and insightful, and free of judgement which made the students feel safe to express their honest opinions and thoughts (Fig. 2). The well-articulated creations and discussions from peers also exposed students to new ideas, perspectives and arguments, which is important to improve the ability to evaluate complex information and communicate in an effective manner.

5.2 Routine

By making interest-driven creation activities a regular part of students' routine, they are more likely to develop a habit of pursuing their interests (Chan et al., 2018; Wong et al., 2020). The instructors consistently motivated the students to upload their creative outputs from learning activity 1 on the Slack platform by 10 AM each morning. This enabled their peers to read and discuss the same throughout the day. As a result, there were a total of 31 issues of

newsletters that were created over a period of 4 weeks by 15 broadcasters while all 57 participants were involved in active and rich discussions which entailed 221 thread posts.

Memes creations were significantly contributed by junior PhD and MTech students (38 students); however, the activity was sporadically participated by all 66 participants, including instructors and alumni. Though there was no specific time allotted for this activity by the instructors, they were continuously encouraged to create and share them on a regular basis. There were a total of 185 memes with 28 thread posts and hundreds of emoticons associated with them from November 2020 to September 2021, when it was the final activity provided by the instructor. The instructors' encouragement to establish a routine for interest-driven creations and discussions amongst the students led to not only consistent engagement with these activities, but also a high volume of creative output.

5.3 Harmony

In the habit loop, harmony refers to the affective outcome of the routine activity as well as the integration or stabilization of habits (Chen et al., 2020). The participants expressed their satisfaction from their engagement with these learning activities (Fig 3a), which in turn led to pursuing the routine activity whenever there was an opportunity. The participants also stated their impatience in anticipation of the upcoming creations from their peers (Fig. 3b), suggesting that they have developed certain habits.

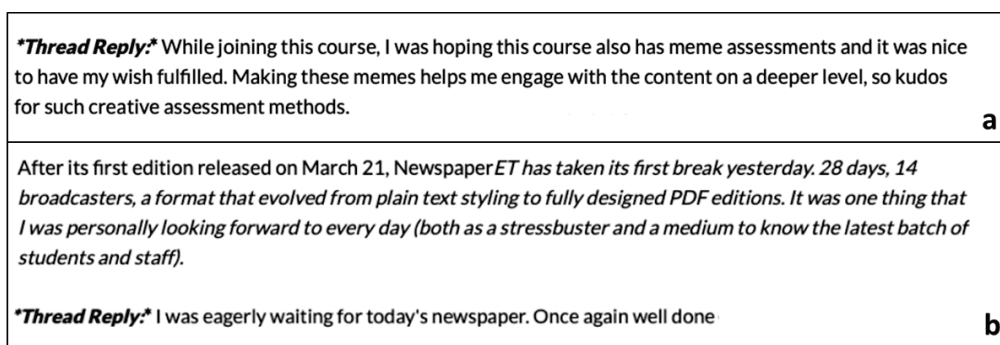


Figure 3: Participants expressing a) satisfaction through these learning activities, and b) their anticipation of similar creations, suggesting development of habitual behavior.

Such habits are likely the results of repeated exposure and active engagement in relevant activities. Both learning activities are still continued to be pursued, sporadically, by the students on Slack platform without indulgence or moderation of the instructor. Over time, the format of the newsletter evolved; however, even after the instructors' involvement ended, 25 articles, with rich discussions, have been generated on that Slack channel by multiple cohorts over a period of 2 years. Likewise, for memes, 61 additional memes were created and shared on Slack subsequent to the instructor's last intervention. The sustained production of these creative outputs also indicated clear evidence of habit activation.

6. Discussion

Creating interest and context-driven learning activities for students is crucial in building habits because it provides a meaningful and enjoyable experience for them. While Slack has previously been utilized as a communication tool to enhance collaborative learning and online engagement (Rouhani, 2020), the present study demonstrates an effective use of the platform for developing positive learning habits, by applying the IDC theory, among graduate students. The pedagogical design exhibits how instructor actions can play a crucial role in developing good learning habits using a ubiquitous learning tool. This also contributes towards one of the questions posed by the creators of IDC theory on training teachers to nurture the interests of students, provide opportunities for meaningful creation, and support

the development of good habits (Chan et al., 2018). The pedagogical approach categorised the teacher's actions into three main components: stimulating the creative interests of students, designing learning activities, and encouraging students to not only start but also sustain engagement in these activities until they become habitual. A crucial element observed during the discussions between instructors and graduate students on their creative outputs was the instructors' openness to embracing constructive disagreements about varying perspectives. The instructors deliberately embraced this attitude to encourage the development of critical thinking to foster learning good habits in their students.

The study highlighted the role of the Slack platform, instructors' actions in the design and application of this intervention, and the interplay of the habit loop components in nurturing the habit of conveying complex ideas in a simple and accessible manner among graduate students. The cuing environment was established through a social and friendly environment provided by the Slack platform, where the instructor modelled interest-driven creation activities and insightful discussions. The use of Slack as a platform enabled graduate students to receive constructive feedback from instructors and peers, leading to enhanced engagement and effective communication of complex information. The routine was established through regular practice of sharing creative products from learning activities on the Slack platform. The harmony, or the affective outcome of the routine activity, was evident in the satisfaction of learning, anticipation expressed by the students for the upcoming creations and continual pursuit of learning activities. The findings of this study can provide valuable insights for educators in this digital world, especially in light of the recent review suggesting the crucial role of the schools in developing good habits for students (Ekman et al, 2022).

Recognizing the positive response to IDC practices in Asia (Looi et al., 2023), this work represents a small attempt to build good learning habits in students through its application. Nevertheless, there were a few limitations associated with the study. The study could not control for potential confounding variables that could influence habit formation, such as prior habits, personality traits, and other external factors. Also, the study measured the development of habits over a short period of time of a few months, and the long-term effects of the pedagogy were not assessed. Further research would be needed to explore the sustainability of the approach. Additionally, the study relied on subjective measures such as satisfaction and motivation to assess habit development. To provide more robust evidence, future research would incorporate markers for quantitative analysis to monitor and record the frequency and duration of engagements in the targeted habit-forming activities.

7. Conclusion

The study utilised the Slack platform to demonstrate a pedagogical approach, rooted in the habit loop of the IDC theory, in building students' learning habits. Cultivating the habit of conveying complex ideas and concepts in a clear and comprehensible manner can greatly benefit graduate students in their career development. This skill not only enhances their proficiency in effective communication, but also improves their ability to establish meaningful connections with others. Leveraging the Slack platform, the instructors supported the development of this learning habit and fostered a culture of peer learning by tapping creative interests of students, designing relevant learning activities and motivating students to regularly engage in these activities. The results of the study have important implications for educators using ubiquitous learning tools to improve their pedagogical practices and cultivate positive learning habits in their students.

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