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Flip & slack – Active flipped classroom learning with collaborative slack interactions

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Flip & Slack - Active Flipped Classroom Learning with Collaborative Slack Interactions

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Abstract: Active flipped classroom learning is stipulated with faculty structuring the activities involving constructive interactions, either formal or informal. Sharing ideas and responding to ideas improve the cognitive skills of the students. Encouraging peers to contribute to class activities and respecting peers contribute to the development of affective skills. We present an integrated platform for cognitive and affective skills development. A flipped classroom arrangement allows the faculty to focus more on in-class activities such as programming and lab exercises to support active learning in computing courses. We share the design of an innovative flipped classroom model integrated with Slack and present the design principles applied to emphasize cognitive and affective skills development through flip-slack model. We evaluate the model on the second-year computing course, Web Application Development II. We share the findings of this case study by analyzing student feedback and their grades.

Keywords: Flipped classroom, active learning, collaborative learning, slack

1. Introduction

Active learning research shows several advantages, and the spectrum includes three popular approaches: collaborative learning, cooperative learning, and problem-based learning (Davidson & Major, 2014; Caceffo et al., 2018; Fassbinder et al., 2015). An organized and strong collaboration between students and instructor is required to achieve the full potential of this approach. Moreover, the instructor's role shifts from knowledge disseminator to learning facilitator. At the same time, students ought to accept more responsibility for their own learning and adapt to a classroom style that is different from that experienced in previous courses. During the learning process, the students develop both cognitive and affective skills which are important for the digital era (Yamamoto & Ananou, 2015; Gokarn et al., 2019). Flipped classroom model enables active learning with the components supporting all the three phases of the spectrum (Maher et al., 2015; Thongmak, 2017). Active learning is stipulated with faculty structuring the activities involving constructive interactions, either formal or informal. Interactions such as sharing ideas and responding to ideas improve the cognitive skills of the students while interactions such as encourage peers on contributions and respecting peers contribute to the development of affective skills (Thongmak, 2017).

Teaching computing courses comes with its own unique set of challenges. The nature of most computing courses requires deep hands-on "practices" of concepts – and this has been the norm across many science and engineering courses around the world (Brown & Atkins, 1996). For learners to truly master the concepts and principles of computing, it is critical that they can put the concepts and principles into solution development. Along with the cognitive skills, the computing students are required to develop the affective skills as there a strong correlation to their learning performance (Wu et al., 2016). Thus, in our school, computing courses are designed to mix both concepts and hands-on lab exercises in a span of three hours of lesson time with a small classroom setting of 45 students to enable strong in-class interactions.

Flipped classrooms are adopted in various courses and at various levels of higher education (Maher et al., 2015; Gehringer & Peddycord, 2013; Lockwood & Esselstein, 2013; Shim et al., 2021). Computing courses have benefited more from this approach due to nature of the content which is information-intensive and skill based. The model enables to develop the cognitive and affective skills efficiently as well (Foldnes, 2016; Mentz et al., 2008). The learning is not only in term of understanding

and remembering but also applying and creating solutions to the problems. The courses are designed with lectures, in-class activities, and projects similar to the real-world cases (Fassbinder et al., 2015).

A flipped classroom arrangement allows the computing faculty to focus more on the in-class activities such as programming and lab exercises to support active learning (Caceffo et al., 2018). It enables the collaborative student learning environment through the group activities such as class diagrams or database modelling, etc. (Lockwood & Esselstein, 2013). Cooperative learning which is a structured process in which team members work towards accomplishing a common goal, stressing positive interdependence, and individual and group accountability is crucial for computing courses. It is achieved with in-class activities such as pair programming or design the web page (Foldnes, 2016; Mentz et al., 2008). Finally, in flipped class, some faculty also integrate Problem-Based-Learning where students are organized into small groups with the goal of solving problems that have some similarity with real world problems such as registration web page creation, creating library database etc., and faculty facilitate the process (Fassbinder et al., 2015).

Interactions in flipped classroom are enabled manually or with technologies such as discussion forums from learning management system or social media such as wiki pages (Hardaway & Scamell, 2005). Computing courses requires a continuous support from the faculty and peer to help fix the bugs in the code or share the algorithms to solve the problems. The support should be provided not only in the classroom but also for the out-of-class activities (Bergmann & Sams, 2012). This requires an efficient and simple interaction platform for faculty and students to discuss the topics and the knowledge is managed with features like teams, search, file sharing, annotations, and audio-video chats. LMS platforms are commonly used for interactions but are limited on the innovative features (Al-Ibrahim, & Al-Khalifa, 2014). Social media provides such free platforms with innovative features such as wiki, Google hangouts, Slack and MS teams are the popular ones to name (Ferreira, 2014; Tuhkala & Kärkkäinen, 2018). Moreover, the Gen-Z students are more comfortable using social media platforms.

In this paper, we share the design of innovative model, flipped classroom integrated with Slack. We focus on the design principles that we applied to emphasize the cognitive and affective skills development thorough the flip-slack model. We evaluate the model on the second-year computing course, Web Application Development II. The impact of the models on students' learning process and the development of cognitive and affective skills was examined. A questionnaire based on the learning theories was developed to evaluate the effectiveness of the model. We share the evaluations of our model by analyzing the student survey, student grades, and lessons learnt.

2. Background

2.1 Cognitive Skills

In flipped classroom, the cognitive skills development methods are also flipped (Eppard, & Rochdi, 2017). Remembering, understanding, and applying are usually achieved out of classroom. The remaining skills are achieved in-class. Instructional methods for in-class are problem-based activities, discussions, and facilitation. We identified typical activities in our school's computing courses and mapped them to different cognitive levels (Table 1).

Table 1. *Cognitive Levels and Activities for Computing Courses*

Cognitive Levels	Achievable Time	Example Activities
Remembering, understanding, & applying	Pre-class	Watching videos, reading slides, attempting quizzes etc.
Analyzing, evaluating, & creating	In-class	Doing quizzes, problems, advanced concepts, & collaborative learning
Evaluating & creating	Post-Class	Extra Exercises, doing course project

2.2 Affective Skills

In flipped classroom, affective skills are mainly developed through interactions. Affective outcomes refer to educational outcomes regarding students' satisfaction, confidence, motivation, emotions, attitudes, and feelings toward learning, the subject matter itself, or educational activities (Krathwohl et al., 1964; Anderson et al., 2001). Affective domain includes five levels. We identified typical activities in our school's computing courses and mapped them to different affective levels (Table 2).

Table 2. *Affective Levels and Activities for Computing Courses*

Level	Description	Example Activities
Receiving	Awareness of the need and willingness to hear selected attention	Watching videos, listening to instructor attentively
Responding	Actively participate in learning and responding to various appearances	Participation in class discussions, presentations, asking questions
Valuing	Ability to judge the worth or value of objects or phenomena and express it	Proposing plans to improve team skills, supporting ideas from the team
Organization	Ability in putting together the ideas, information, and create a value system	Comparing the ideas, relate to the main problem, prioritize time effectively
Characterization	At the highest level the value has been "internalized"	Work efficiently independently or in teams, and practices ethics.

2.3 Flipped Classroom Basic Model

Theoretical frameworks help the faculty to design the flipped classroom model suitable for their course and are broadly categorized into two types: student-centered learning theories and teacher-centered learning theories. Most popular theories applied for such designs include, Bloom's taxonomy, active learning, problem-based learning, collaborative learning, experiential learning, theory of reasoned action, self-determination theory, behaviorist theory, and constructivist theory. These theories aim at the cognitive and affective skills development in a student to achieve the better outcomes of the flipped classroom (Bishop et al. 2013). Table 3 shows the components, examples, and benefits of each component in the flipped classroom.

Table 3. *Flipped Classroom Components*

Components	Examples	Benefits for flipped class
Student-centered learning theories	- Constructivist theory (Vygotsky, 1978; Grabinger & Dunlap, 1995), - Peer-assisted learning (Topping & Ehly, 1998)	- Critical thinking - Communication and collaboration skills - Motivation and responsibility
Teacher-centered learning theories	- Behaviourist theory (Watson, 1920; Skinner, 1948)	- Expert knowledge - Organized and disciplined - Effective evaluations
Out-of-class activities	- Read textbook - Watch Videos - Take online quiz - Submit programs	- Personalized learning support - Mobile learning support - Autonomous learning Support - Cognitive and affective skills development - Improved self-learning ability
In-class activities	- Pair Programming Labs - Group Problem Solving Activities - Flexible Quiz Activities	- More interactions with instructor - Collaborative learning support - Cognitive and affective skills development - Increased material retention

According to Moore's theory, students construct their interactions with four types of elements, namely, peers, instructors, contents, and technologies either in-class or outside of the class time (Moore, 1989). Out of classroom interaction platforms most commonly employed in flipped classroom are LMS

or social media platforms like wikis and blogs (Ferreira, 2014). Slack, MS Teams, and Google Hangouts are similar platforms, and we choose Slack due to some free features not available in other tools (Tuhkala & Kärkkäinen, 2018) such as efficient conversation segmenting, tracking and searching via custom channels, social interactions via 'mentioning' (similar to popular social media platforms such as Facebook, Instagram and Twitter), and built-in analytics.

2.4 Web Application Development Courses

In our school, all students must complete two web application development courses. Web Application Development course (WAD I) equips students with the knowledge and skills to develop database-driven web applications using HTML, PHP, and MySQL. Upon successful completion of WAD I, Web Application Development course (WAD II) teaches students how to develop well-styled and responsive web applications that provide rich user experiences using HTML, CSS, Bootstrap, JavaScript, and Vue.js. While WAD I focuses fully on back-end development centering around client-server architecture, WAD II builds on top of WAD I by teaching students how to develop full-stack web applications and also explores interactions with external APIs.

3. Flip & Slack Model

3.1 Research Questions

Diversity in students' learning styles and motivation challenges can be addressed by flip model and facilitate both personalized and collaborative learning (Goedhart et al., 2019). Our first set of questions study the impact of the flip-slack model on the learning process.

RQ1: What is the impact of flipped class on the learning process?
RQ2: What is the impact of slack interactions on the learning process?

Development of cognitive and affective skills can be achieved through successful interactions (Johnson & Johnson, 2002) and effective teaching principles (Bishop et al. 2013) employed in flipped classroom. Our second set of questions study the impact of the flip-slack model on the development of skills.

RQ3: Does the flip-slack model improve cognitive skills?
RQ4: Does the flip-slack model improve affective skills?

To assess the statistical significance of the model, we study the correlations between self-assessed skill development and students' performance on course assessments.

RQ5: What is the relationship between skills developed and student grades?

3.2 Flip & Slack Design

Based on the previous frameworks and theories, we propose flip-slack teaching model built on cognitive and affective principles (Figure 1).

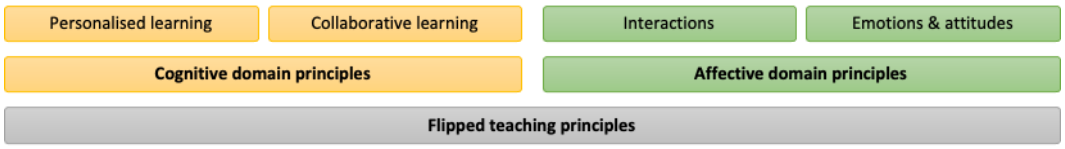


Figure 1. Flip-Slack Classroom Model – A Platform for Cognitive and Affective Skills Development.

Flipped classroom design aims at active (student-centered) learning, flexibility, and simplicity. The fundamental principles can be categorized under in-class and out-of-class as described below:

1. Out-of-class: Enable effective learning by using instructor created short videos that ensure Coherence, attention guiding effect, segmentation, learner control effect, engagement effect, encouraging mental model making, learner control effect, misconception effect and integrated

practice activities. Use online exercises and discussion forums to motivate students' class participation.

2. In-class: Activate student's motivation with formative assessments such as quiz and feedback on their submissions. Use group activities to enable active learning by solving varied tasks and real-world problems.

Cognitive design aims at the intellectual skills development by enforcing components of active learning in the classroom delivery as shown below:

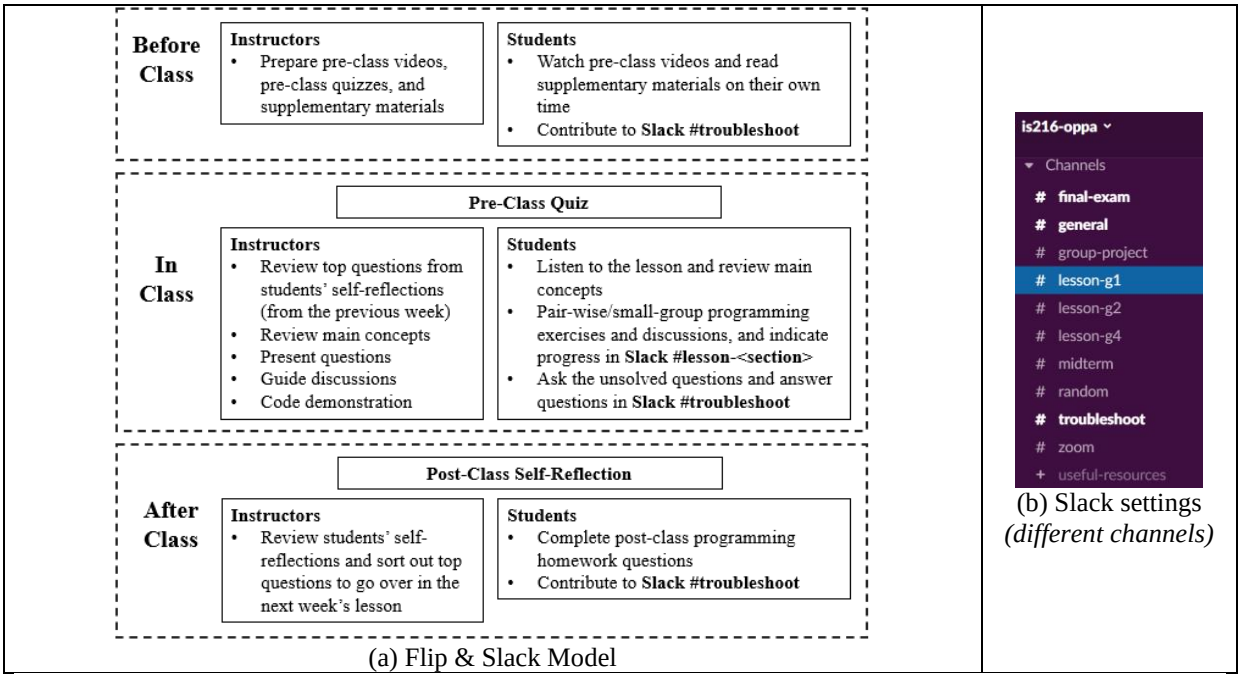
1. Before class: Focus on remembering and understanding cognitive levels by assessing the students on basic topics via online quizzes which are individual and flexible activities enabling personalized learning.
2. In class: Focus on applying and analyzing cognitive levels by organizing and assessing the students on advanced topics via group activities supporting collaborative learning.
3. After class: Focus on evaluating and creating cognitive levels by assessing the students on individual or group projects.

Affective design aims at the social skills development by enabling interactive platforms and opportunities to demonstrate appropriate emotions and attitudes.

1. Before class: Focus on receiving and responding affective levels by watching videos, reading online-discussions, and replying to the online-discussions promoting interactions.
2. In class: Focus on valuing and organization levels by participating in the group activities and discussions with the facilitators.
3. After class: Focus on characterizing level by collaborating on the large-scale course projects or assignments with strong interactions and ethical practices on the technology platforms.

3.3 Flip & Slack Model – Case Study

Figure 2 depicts the flip and slack settings for WAD II course based on the principles presented in previous section. The figure shows the flipped classroom structure and Slack channels design.



(a) Flip & Slack Model

(b) Slack settings *(different channels)*

Figure 2. Flip & Slack Settings for WAD II Course.

Each week, students are given next week's lesson videos and materials for out-of-class activities. Students study slides and watch short videos. During the lesson time, the teaching team, 1) review student feedback from the previous week, 2) review common questions from the previous week, 3) recap on the current week's concepts, 4) give in-class "hands-on" challenges to students, and 5) utilize the remaining class time for one-on-one or small group-based consultation where the teaching team members actively walk around and mentor students on coding, debugging and other course-related

individual or group actives. The teaching team members alternate checking on questions posted in Slack – and provide online consultation as and when necessary.

Two types of users are created in Slack: 1) administrators (faculty and teaching assistants), 2) general users (students). Administrators can create and edit channels, manage users, configure settings (e.g. installation of extensions), and view analytics. We created a separate public channel for each topic. Channel "general" is for making announcements class announcements. Channel "troubleshoot" is for technical troubleshooting where students and teaching team members post questions and answers concerning hands-on lab exercises. During the class time, section-specific channels (e.g. lesson-g1 is for section G1) are used to facilitate discussions and class participation. At the start of the term, all students are briefed about "Do's and Don'ts" (a.k.a. Slack usage etiquette). The guidelines include but are not limited to: 1) stay on topic, 2) search first and then ask if unable to find solutions online, 3) remember that nothing is private online, and 4) be careful with your tone and use respectful language.

4. Flip & Slack Model – Evaluations

This study involved two instructors, four teaching assistants, and 145 students. Three sets of data are collected to better understand students learning experience. To answer **RQ1** and **RQ2**, we conducted a Likert-scale based survey. It focuses on learning via two designs: Flip design and Slack design. To analyze the findings from survey, we collected the Slack data and explored the student interactions. To answer **RQ3**, **RQ4** and **RQ5**, we conducted the Likert-scale based survey on cognitive and affective skills. Both scales are on 5 points: Strongly agree (SA), Agree (A), Neutral (N), Disagree (D), Strongly disagree (SD). We also collected qualitative feedback during the survey process to conduct qualitative analysis on the model. In Tables 4, 5 and 6, column S is 'Skewness' and column **K** is 'Kurtosis'.

Table 4. *Survey Results on Impact of Flip-Slack Model on Learning Experience*

Learning	Question	SA	A	N	D	SD	S	K
	Flip design on learning							
General	The instructor has effectively organized each week's flipped classroom activities.	50%	46%	4%	0%	0%	-0.5	-0.7
PL	I learn more through flipped classroom method than the traditional method.	38%	27%	23%	12%	0%	-0.6	-0.7
PL	I can follow the lessons better after watching the videos.	50%	43%	6%	1%	0%	-1.5	4.1
PL	Learning through flipped classroom makes me anxious	11%	26%	24%	39%	0%	0.3	-0.9
CL	Interactions during in class hours are sufficient for learning.	22%	47%	18%	13%	0%	-0.5	-0.5
CL	My peer interactions in the classroom have strengthened.	18%	31%	32%	18%	0%	-0.2	-0.7
CL	My interactions with faculty in classroom have strengthened.	22%	37%	28%	13%	0%	-0.4	-0.5
	Slack design on learning							
General	Topics discussed are relevant to the course.	44%	49%	6%	1%	0%	-1.3	3.6
PL	Instructor gives us useful and immediate feedback in Slack.	55%	35%	10%	0%	0%	-1.4	2.8
PL	Slack helps me with reviewing the topics covered in class.	26%	46%	20%	7%	0%	-0.7	0.1
PL	Social interactions make me anxious.	7%	28%	27%	38%	0%	0.2	-0.9
CL	Slack allows me to share ways to solve the challenges in the course.	38%	43%	17%	2%	0%	-0.9	0.8
CL	Interactions in Slack complement the learning from classroom interactions.	19%	60%	17%	4%	0%	-0.9	1.7

CL	Using Slack, my interactions with my peers outside classroom have strengthened.	11%	19%	39%	31%	0%	0.4	-0.5
CL	Using Slack, my interactions with faculty outside classroom have strengthened	18%	41%	30%	11%	0%	-0.3	-0.4

Table 5. *Survey Results on Impact of Flip-Slack Model on Cognitive Skills*

Cognitivism	Question	SA	A	N	D	SA	S	K
Understanding	I am able to understand the concepts covered in the course.	47%	50%	3%	0%	0%	-0.3	-1
Remembering	I am able to remember (list, describe, identify, and answer questions) concepts.	33%	56%	9%	2%	0%	-0.6	0.8
Evaluating	I am able to debug the web layout using the concepts, using debugging tools.	36%	53%	9%	1%	1%	-1.1	2.9
Creating	I am able to create a web page using the concepts taught in the course.	41%	56%	3%	0%	0%	-0.1	-1
Analyzing	I am able to determine how web components are interrelated in a web.	41%	54%	5%	0%	0%	-0.2	-0.7
Applying	I am able to design a web layout using the components taught in the course.	40%	54%	5%	1%	0%	-0.6	0.8

4.1 Impact of flip & Slack Model on Learning

To evaluate *RQ1* and *RQ2*, we designed the survey questions to study the impact of flip on personalized learning (PL) and collaborative learning (CL). The summary of survey results is depicted in Table 4. Answer to *RQ1* from flip design survey: The data indicate moderately skewed for all questions except for "Following lessons" and more weight in tails (k=4.1). For all other questions, the values are within the range indicating reasonable sample size. The summative results of the survey on flip design suggest that flipped classroom concept is generally well received by students (65%) as compared to the traditional method, although a third of the students (37%) still feels anxious about such learning pedagogy. Students respond positively towards how the weekly class are organized (96%) and video-based learning (93%). We do observe that there are fewer interactions between the students (49%) and instructors (59%) in the classroom. Flipped classroom has a significant positive impact on the personalized learning and average positive impact on the collaborative learning. Peer interactions were not as successful due to the university-wide restriction on the maximum students allowed on campus.

Answer to *RQ2* from slack design survey: The data collected indicate moderately skewed for all questions except for "instructor feedback" and more weight in tails (k=2.8). For all other questions, the values are within the range indicating reasonable sample size. The survey results show that the use of Slack as a tool allows students to share and exchange solutions and knowledge in the weekly challenge (81%) and complements classroom learning (79%). Students can receive useful and quick feedback (90%) which are useful when they review on the topics covered in the course (72%). More importantly, students find the topics discussed on Slack are relevant to that of the course (93%). We do observe the similar pattern that there are fewer interactions between the students (30%) and instructors (59%) outside the classroom. Similarly, almost third of the students (35%) are anxious on Slack platform. To answer *RQ2*, slack interactions have a significant positive impact on the personalized learning and average positive impact on the collaborative learning. In our analysis, we observe that the peer interactions outside the classroom were not as successful as expected. Several factors may attribute to this behavior such are students are dependent on instructors on the answers for complex coding questions, or students of the same group tend to interact on the social media giving less room for peer collaborations.

4.2 Cognitive Skills Development

To evaluate **RQ3**, we designed the survey questions to study the impact of flip-slack on cognitive levels and learning outcomes. The summary of survey results is shown in Table 5. The data collected indicate moderately skewed for all questions except for "evaluating (s=-1.1)" and more weight in tails (k=2.9). For all other questions, the values are within the range indicating reasonable sample size. A large majority of the students indicate that they are able to understand, remember, evaluate, create, analyze, and apply web development concepts learned in the course. To answer **RQ3**, the flip-slack model has a significant positive impact on cognitive skills development.

4.3 Affective Skills Development

To evaluate **RQ4**, we designed the survey questions to study the impact of flip-slack on affective levels and student behavior. The summary of survey results is depicted in Table 6.

Table 6. *Survey Results on Impact of Flip-Slack Model on Affective Levels*

Affective levels	Question	SA	A	N	D	SA	S	K
Receiving	I read all the questions and answers discussed by my classmates.	17%	43%	19%	21%	0%	-0.4	-0.7
	I watch all the videos or content posted by the instructor.	50%	45%	5%	1%	0%	-0.9	0.9
Responding	I actively participate in class discussions.	13%	32%	35%	20%	0%	-0.1	-0.6
	I initiate ideas on the solutions to my classmates.	19%	31%	35%	15%	0%	-0.3	-0.5
Valuing	I support/debate with others' posts by like/dislike or appreciation or with replies (e.g. stickers).	22%	34%	29%	15%	0%	-0.4	-0.6
	I am committed to the course and respect my classmates.	51%	45%	4%	0%	0%	-0.5	-0.7
Organization	I know the Slack and classroom rules and ethics and follow them.	49%	46%	6%	0%	0%	-0.5	-0.6
	I plan and organize events/tasks systematically to solve problem.	23%	58%	15%	5%	0%	-0.7	0.6
	I am able to prioritize my time to meet the goals of the team.	39%	53%	6%	2%	0%	-0.8	1.3
Characterization	I am able to work on given problems independently.	31%	61%	5%	4%	0%	-1	2.1
	I am able to lead activities/ discussions in Slack and in class.	13%	26%	42%	19%	0%	0	-0.4
	I give objective problem solving methods.	15%	59%	23%	3%	0%	-0.7	1.5

The data collected indicate moderately skewed for all questions and more weight in tails for "time prioritization (k=1.3)", "independent work attitude (k=2.1)" and "provide objective solutions (k=1.5)". For all other questions, the values are within the range indicating reasonable sample size. The survey included questions to determine the affective outcome of active learning adopted in the course. While the students are committed to the course and respect their classmates (96%), only half show the appreciation with replies or indicators (56%) on Slack. While in class, less than half actively partake in class discussions (45%) and half propose solutions to their classmates (50%). Although students are receptive to postings by the instructors (95%), the percentage is much lesser for their peers (60%). On a positive note, high percentage of students indicate that they are aware of the ethical issues in Slack (95%). Students are able to plan and organize events and tasks systematically to solve the given problem (81%) and work towards the goals effectively (92%). Students are also able to work on the given problems independently (92%). To answer **RQ4**, the flip-slack model has an average positive

impact on affective skills development. We performed a correlation analysis to further study the correlations between self-reflections on skills development and student course grades.

4.4 Correlations between the Skills Development and Grades

To answer **RQ5**, we use Pearson correlation coefficient scores between the skills ratings and student grades. Table 7 shows the correlations. For cognitive skills, Table 7 shows significant weak positive correlations with stronger p-values (<=0.05) for all levels except remembering. This may be because the students practice and prepare for exams whereas for the weekly classes, they are not putting efforts on remembering skills. For affective skills, Table 7 shows no significant evidence with higher p-values (<=0.05) for all affective levels. This indicates no relationship between grades and affective skills development. Recall from a previous analysis that students reported average scores on affective skills development through interactions. However, the grades of the students are higher indicating inconclusive results on affective skills. To answer **RQ5**, we observe a significant weak positive correlation between cognitive skills developed and grades whereas no significant evidence for affective skills developed. To deeply understand this observation, further investigation is required by performing content analysis on Slack messages.

Table 7. *Correlations between Self-assessed Skills Development and Course Grades*

Cognitive Skills	**Pearson r**	**p-value**		**Affective Skills**	**Pearson r**	**p-value**
Understanding	0.234	0.01*		Receiving	-0.108	0.27
Remembering	0.149	0.12		Responding	0.044	0.65
Evaluating	0.207	0.03*		Valuing	-0.012	0.90
Creating	0.241	0.01*		Organization	-0.052	0.59
Analyzing	0.217	0.02*		Characterization	0.164	0.09
Applying	0.17	0.05*				

5. Limitations & Future Work

This study is a first attempt to examine and evaluate the flip-slack model for designing and delivering computing courses. Several notable caveats are worth mentioning in our work. Firstly, a formal control group experiments would provide more persuading data with regards to the impact of the flip-slack model on the student learning experience. Secondly, students' attitudes and perceptions can influence their learning (Candeias et al., 2011; Shamsuddin et al., 2018). If students' attitudes towards and perceptions of a new form of learning (such as video-based learning, social media interactions, etc.) are positive, their learning experience is likely to be enhanced. Students that strongly prefer only instructor-led lectures may respond negatively towards this form of learning, and thus, their learning experience will suffer. Combining findings from a deeper investigation into students' attitudes and perceptions would lead to a more comprehensive understanding of factors that influence students' learning. Thirdly, from our survey, we also observed that students rated low for interactions and this factor may impact the learning experience of the students. Content analysis on the posts and peer interaction analysis using social network mining would help to understand the factors affecting the interactions. Finally, the affective skills are analyzed using the student self reflections and this can be a limitation of the survey approach. Emotion analysis using emoticons and mention analysis of acknowledgements provide substantial evidence for the insights into affective skills development.

6. Conclusion

This paper presents an integrated platform for cognitive and affective skills development. We share the design of an innovative flipped classroom model integrated with Slack and present the design principles applied to emphasize cognitive and affective skills development through the flip-slack model. In our case study, the analysis of the student survey responses reveals that flipped classroom and Slack

interactions have a significant positive impact on the personalized learning and average positive impact on the collaborative learning. Further, it indicates that the flip-slack model has a significant positive impact on cognitive skills development and an average positive impact on affective skills development.

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