Learning Analytics for Quality Assurance in Higher Education

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Overview

Introduction – Problem Definition

Research Aim / Objectives and Questions

Literature review

Research Methodology

Results

Future Work

Problems faced by the university students in Sri Lanka

➢ Lecturers merely use VLE as a platform to only upload the materials (either ppt or pdf). The usage of interactive content is minimal.

➢ Even though VLEs collect a massive amount of students' learning data, using those data to identify the hidden patterns and deep insights to enhance the learning environment is minimal.

➢ There is no real-time feedback given to students about their performance and progress in a course.

➢ There is no way to improve the motivation and self-confidence of students to increase their learning engagement and grades.
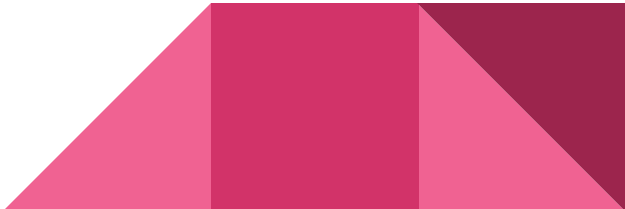
Due to COVID-19 Pandemic

➢ Sri Lankan universities delivered courses on fully online mode.

➢ The interaction between the students and the lecturer is minimal.

➢ The students cannot track whether they are in the expected performance level, their progress in the course, and their performances compared to the rest of the class.

➢ Students are isolated in the digital environment in a fully online mode, which causes less motivation to interact with the learning activities.

Research Aim

➢ This research investigates the application of Learning Analytics for improving students' motivation, interaction, self-confidence, and grades by designing, implementing, and evaluating a Technology-Enhanced Learning Analytic Dashboard system (hereafter referred to as the TELA System).
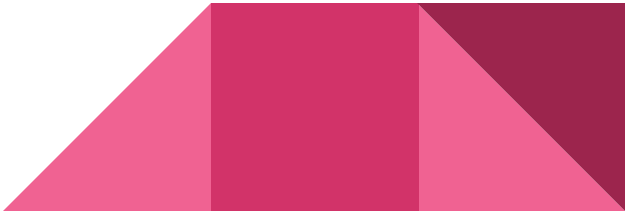
Research Objective

➢ Introduce the TELA system to improve the motivation, interaction, self-confidence, and grades of the students.

Research Questions

RQ1: What are the information that needs to be visualized in the TELA system to support students to improve their motivation, interaction, self-confidence, and grades?

RQ2: How to design and create the TELA system to support students to improve their motivation, interaction, self-confidence, and grades?

RQ3: Can the TELA system support students to improve their motivation, interaction, self-confidence, and grades?

Literature Review

Learning Analytics (LA)

"Learning Analytics is the measurement, collection, analysis and reporting of data about learners and their contexts, for purpose of understanding and optimizing learning and the environments in which it occurs"

1st Learning Analytics and Knowledge Conference [1]

[1] R. Ferguson, Learning Analytics: drivers, developments and challenges, International Journal of Technology Enhanced Learning, 4(5-6), pp. 304—317,2012.

Introduction

Learning Analytics is a multi-disciplinary field.

Introduction

Learning Analytics (LA)

➢ LA applies different techniques to detect interesting patterns hidden in educational data sets.

  ❑ Data Mining (Knowledge Discovery in Databases)
  ❑ Machine Learning
              - Classification / Clustering / Association Rule Mining
  ❑   Social Network Analysis (SNA)
  ❑   Information Visualization
  ❑   Statistics

Introduction

Learning Analytics (LA)

➢ The application of LA can be oriented towards different stakeholders

Teachers

Students

Educational Institutes

Researchers

Four types of Learning Analytics

Learning Analytic Type	Description	Examples
Descriptive Analytics	Show what has happened using charts (pie charts, line charts, and bar charts) and text format.	• Number of dropout students from a degree. • Number of enrolled students for a course.
Diagnostic Analytics	Explain why a particular thing happened by analyzing data.	• Why did a student fail an exam? • Why a student dropped out of the course?
Predictive Analytics	Predict what will happen next based on the analysis from past events.	• Which students will not pass the exam? • Which course will have a lower number of registrations?
Prescriptive Analytics	Help the students to achieve their learning goals.	• Suggest Learning Plans. • Suggest additional learning resources.

Methodology

➤ This research is based on the Design Science Research Process, a problem-solving approach by developing a new IT product called artifact (Saltuk and Kosan 2014).

➤ The Design Science Research Process is used in an iterative process involving five steps (Saltuk and Kosan 2014; Oates, 2006).
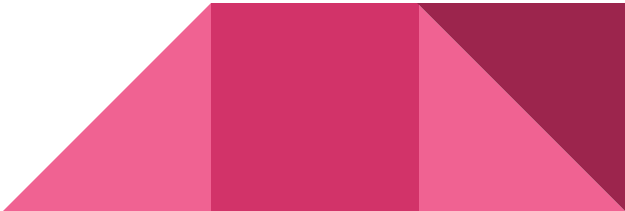
Methodology
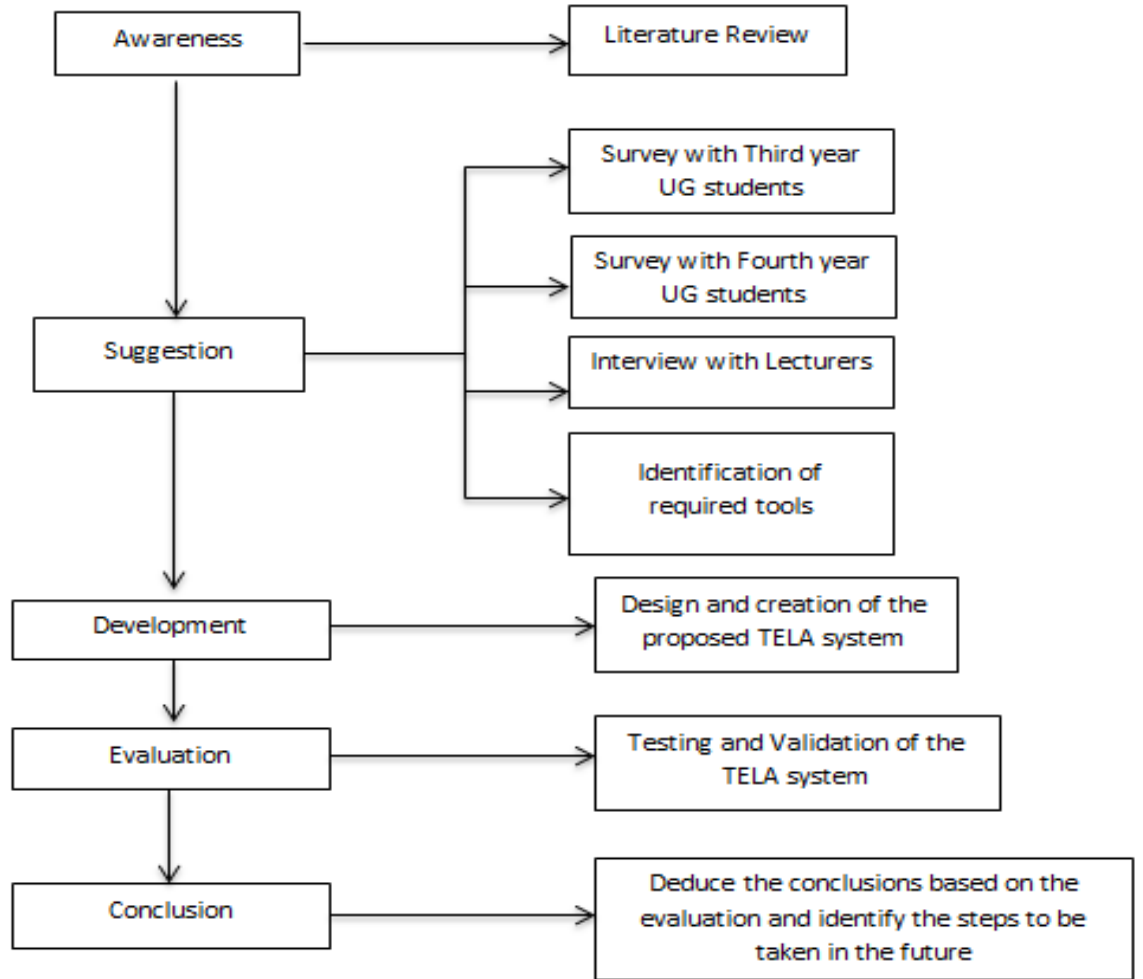
TELA system with the Learning Analytic dimensions

Dimension	Description
What kind of data?	Learner's data collected in the Moodle database.
Who are the stakeholders?	Undergraduate students of the UCSC.
Why does the system use Learning Analytics?	To improve the motivation, engagement, self-confidence, and grades of the students.
How does the system perform the analysis	Descriptive and Diagnostic analytics using statistics, data mining, and information visualization.

Results

RQ1: What are the information that needs to be visualized in the TELA system to support students to improve their motivation, interaction, self-confidence, and grades?

➢ We conducted two separate surveys with third-year and fourth-year undergraduate students of the UCSC

➢ 83 - Third-year students participated in the survey.

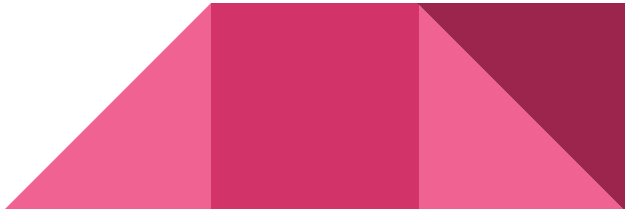➢ 54 - Fourth-year undergraduate students participated in the survey.

Survey Results of Third-Year Students

Expected TELA system features	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
Graphical visualization of time spent for online learning activities	36.6%	54.9%	8.5%		
Provide feedback about your performance after completion of Quizzes	57.3%	36.6%	6.1%		
Inform about sub-topics that you need to improve your performances	53.7%	40.2%	6.1%		
Graphical visualization of activities completed inside a course	46.3%	46.3%	7.3%		
Early detection of risk of failures	51.2%	36.6%	11%	1.2%	
Graphical visualization of your performance and progress over different periods	51.2%	37.8%	11%		
Evaluation of former and current grades and predictions for future grades	40.2%	48.8%	8.5%	2.4%	
Performance comparison with your peers	28%	45.1%	18.3%	4.9%	3.7%
Suggest learning partners (nearby, same knowledge, same learning pattern) for grouping and collaboration of learning activities	25.6%	46.3%	23.2%	3.7%	1.2%
Support to improve your grades by planning your learning activities and manage time efficiently	39%	46.3%	14.6%		

Survey Results of Fourth-Year Students

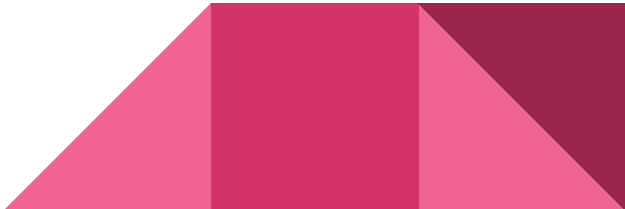| Expected TELA system features	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
Graphical visualization of time spent for online learning activities	46.3%	42.6%	11.1%		
Provide feedback about your performance after completion of Quizzes	74.1%	20.4%	5.6%		
Inform about sub-topics that you need to improve your performances	63%	27.8%	9.3%		
Graphical visualization of activities completed inside a course	51.9%	40.7%	7.4%		
Early detection of risk of failures	61.1%	24.1%	13%	1.9%	
Graphical visualization of your performance and progress over different periods	59.3%	37%	1.9%		1.9%
Evaluation of former and current grades and predictions for future grades	46.3%	37%	9.3%	3.7%	3.7%
Performance comparison with your peers	29.6%	31.5%	29.6%	7.4%	1.9%
Suggest learning partners (nearby, same knowledge, same learning pattern) for grouping and collaboration of learning activities	24.1%	38.9%	25.9%	5.6%	5.6%
Support to improve your grades by planning your learning activities and manage time efficiently	51.9%	42.6%	5.6%		

Interview results with lecturers

➢ The lecturer should upload the lecture materials as interactive content. If the lecturer uploads the lecture notes in pdf or PowerPoint format, students will download them and read them offline. Therefore, we cannot capture the learning happening outside the VLE.

➢ The lecturer should provide a Quiz after completing each sub-topic. The TELA system needs to analyze the Quiz data and visualize it to the students. Students can easily monitor their performance level, progress and compare their current status with the peers.
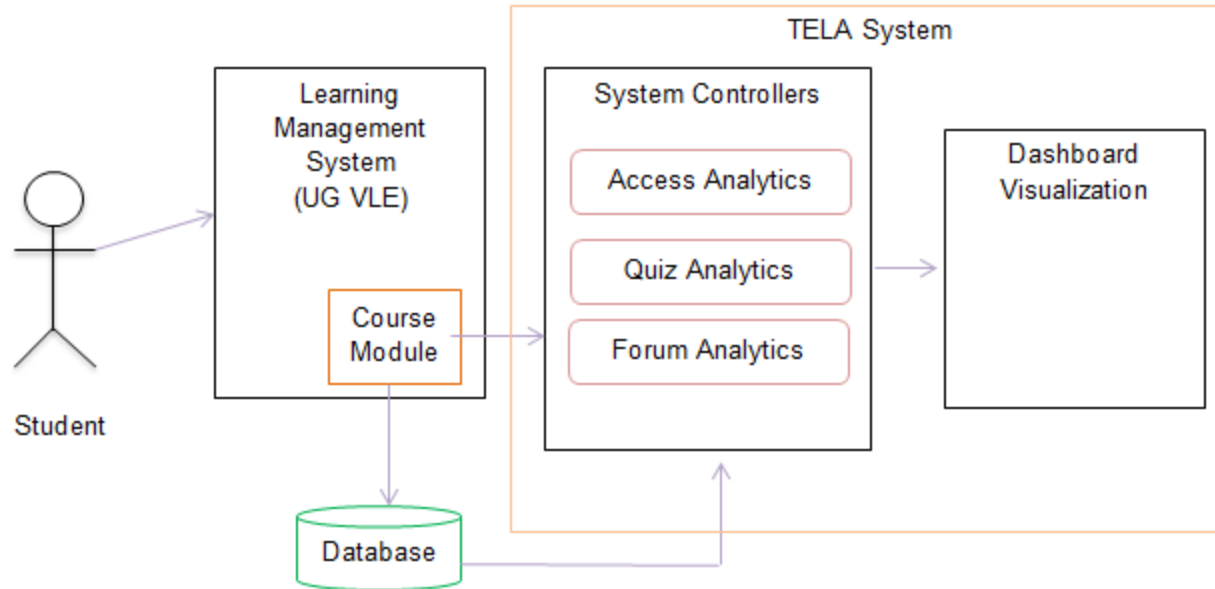
Interview results with lecturers

➢ Students' interaction with the Forum discussions is minimal in Sri Lanka. Considering this aspect, lecturers asked to build a feature for Forum Analytics where students can quickly identify the discussion topics with a higher number of comments.

➢ The TELA system interfaces should keep simple, where students can easily understand the visualizations.

RQ2: How to design and create the TELA system to support students to improve their motivation, interaction, self-confidence, and grades?

➢ Undergraduate Virtual Learning Environment (UGVLE) is the VLE used by UCSC to facilitate the teaching, learning, and assessment activities of undergraduate students.

➢ UGVLE is a Moodle-based VLE system, and we decided to implement the TELA system as a Moodle plugin since we can easily install it to the UGVLE.

RQ2: How to design and create the TELA system to support students to improve their motivation, interaction, self-confidence, and grades?

RQ2: How to design and create the TELA system to support students to improve their motivation, interaction, self-confidence, and grades?
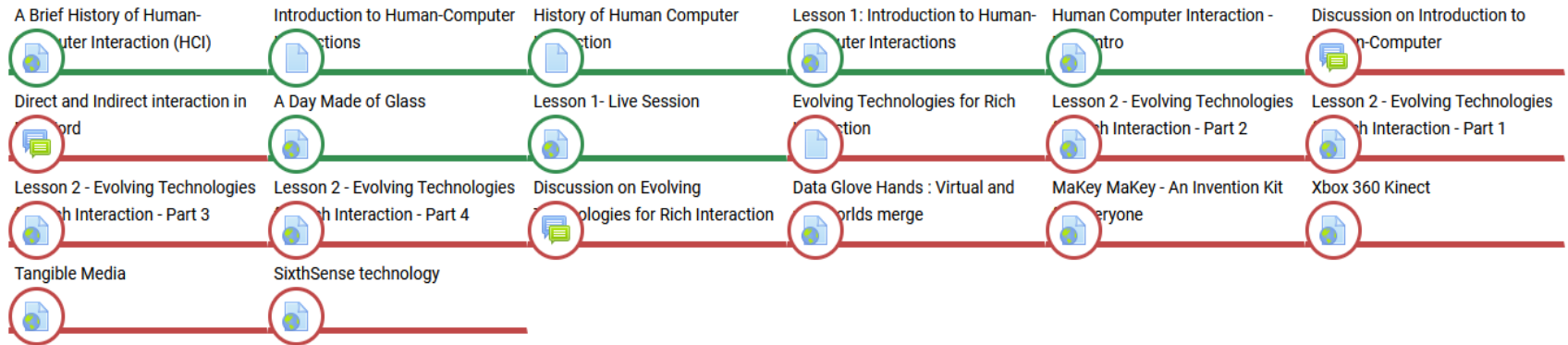
TELA Dash Board – Access Analytics

Access Analytics of

Progress is 45%

A Brief History of Human-Computer Interaction (HCI)	Introduction to Human-Computer Interactions	History of Human Computer Interaction	Lesson 1: Introduction to Human-Computer Interactions	Human Computer Interaction - Intro	Discussion on Introduction to Human-Computer
Direct and Indirect interaction in the Word	A Day Made of Glass	Lesson 1- Live Session	Evolving Technologies for Rich Interaction	Lesson 2 - Evolving Technologies for Rich Interaction - Part 2	Lesson 2 - Evolving Technologies for Rich Interaction - Part 1
Lesson 2 - Evolving Technologies for Rich Interaction - Part 3	Lesson 2 - Evolving Technologies for Rich Interaction - Part 4	Discussion on Evolving Technologies for Rich Interaction	Data Glove Hands : Virtual and Real worlds merge	MaKey MaKey - An Invention Kit for Everyone	Xbox 360 Kinect
Tangible Media	SixthSense technology				

TELA Dashboard - Access Analytics

TELA Dashboard - Access Analytics

Daily Access Count

Access Details

TELA Dashboard - Access Analytics

Daily Action Count - All courses

- SCS3209/IS3102 Human Computer Interaction
- SCS3205 / CS3105 Computer Graphics I
- SCS3203 / IS3108 Middleware Architecture
- SCS3202 / CS3102 Advanced Computer Architecture
- SCS3214 / IS3113 Group Project II
- SCS3210 / IS3109 Systems and Network Administration
- SCS3201 / IS3117 / CS3120 Machine Learning and Neural Computing
- SCS3206 / CS3106 - Graph Theory
- ENH3201/EN3101 Industrial Placements - 2021/2022

TELA Dashboard - Access Analytics

Daily Access Count - All courses

Legend:
- SCS3200/IS3102 Human Computer Interaction
- SCS3205 / CS3105 Computer Graphics I
- SCS3203 / IS3108 Middleware Architecture
- SCS3202 / CS3102 Advanced Computer Architecture
- SCS3214 / IS3113 Group Project II
- SCS3210 / IS3109 Systems and Network Administration
- SCS3201 / IS3117 / CS3120 Machine Learning and Neural Computing
- SCS3206 / CS3106 Graph Theory
- ENH3201/EN3101 Industrial Placements - 2021/2022

X-axis: 19th April 2021, 20th April 2021, 21st April 2021, 22nd April 2021, 23rd April 2021, 24th April 2021, 25th April 2021, 26th April 2021, 27th April 2021, 28th April 2021, 29th April 2021, 30th April 2021, 1st May 2021, 2nd May 2021, 3rd May 2021, 4th May 2021, 5th May 2021, 6th May 2021, 7th May 2021, 8th May 2021, 9th May 2021, 10th May 2021, 11th May 2021, 12th May 2021, 13th May 2021, 14th May 2021, 15th May 2021, 16th May 2021, 17th May 2021, 18th May 2021

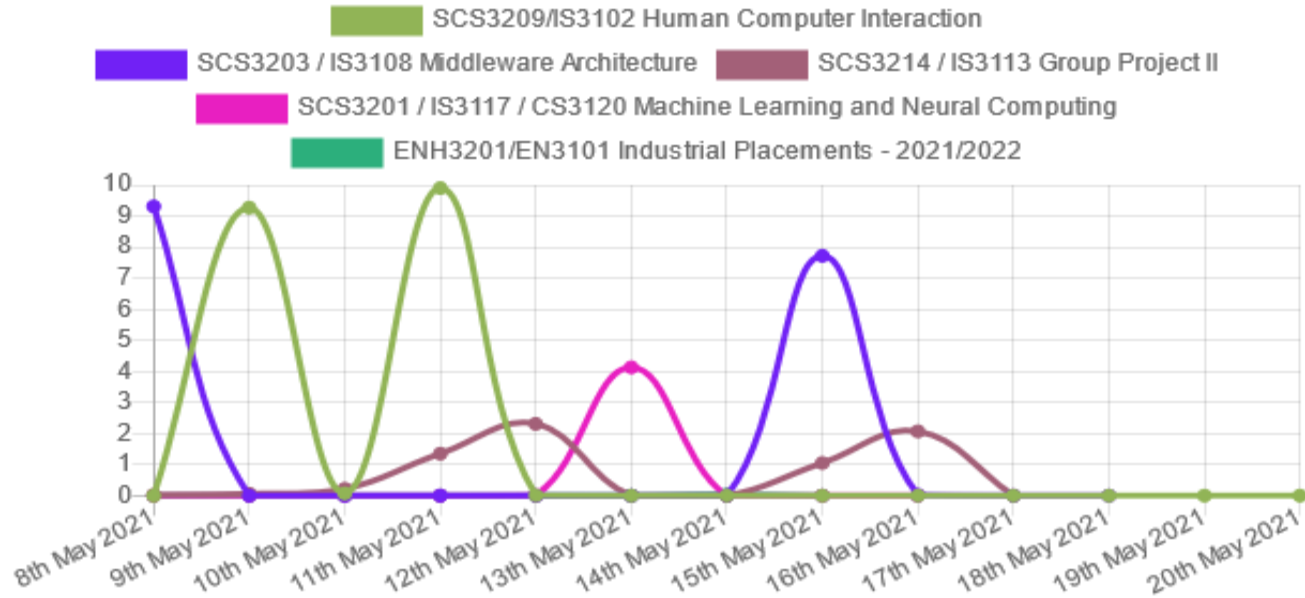# TELA Dashboard - Access Analytics

Daily Online Time

TELA Dashboard - Access Analytics

Daily Online Time - All courses

Legend:
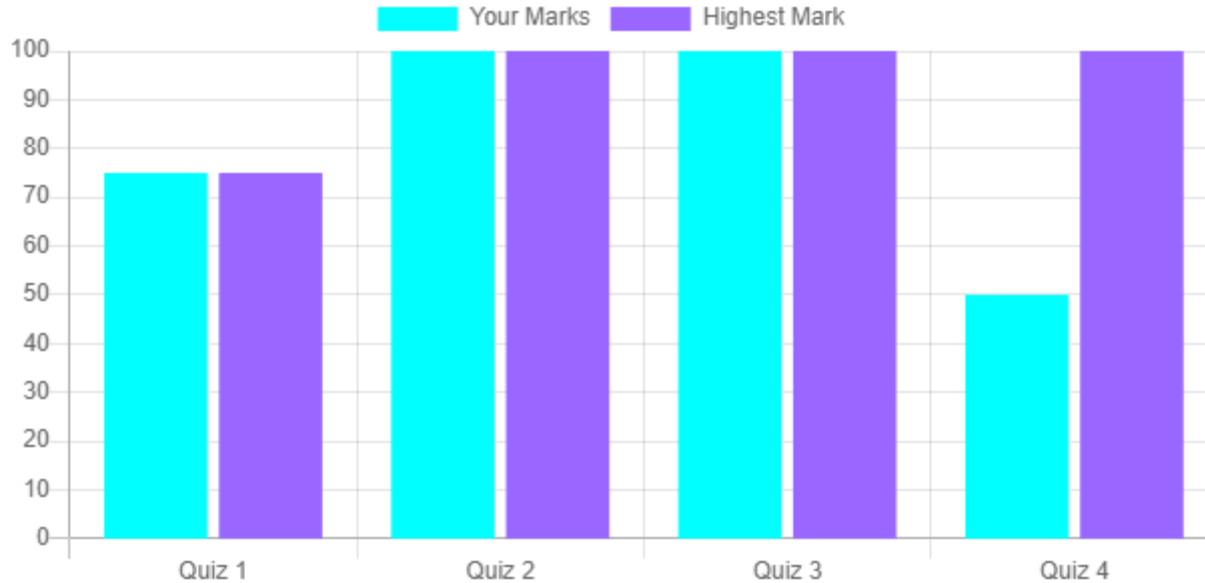- SCS3209/IS3102 Human Computer Interaction
- SCS3203 / IS3108 Middleware Architecture
- SCS3214 / IS3113 Group Project II
- SCS3201 / IS3117 / CS3120 Machine Learning and Neural Computing
- ENH3201/EN3101 Industrial Placements - 2021/2022

TELA Dashboard – Quiz Analytics

Quiz Marks with Class Average

Your Marks · **Class Average**

	Quiz 1	Quiz 2	Quiz 3	Quiz 4
Your Marks	75	100	100	50
Class Average	50	50	58	83
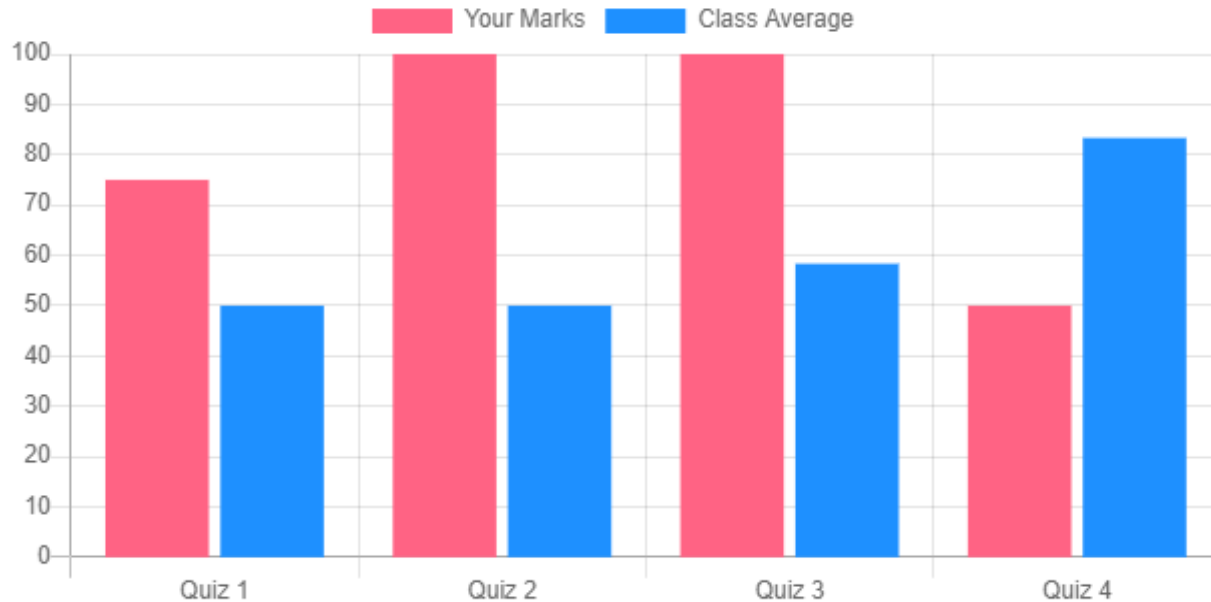
TELA Dashboard – Quiz Analytics

Your Marks with Highest Marks

Legend: ■ Your Marks ■ Highest Mark

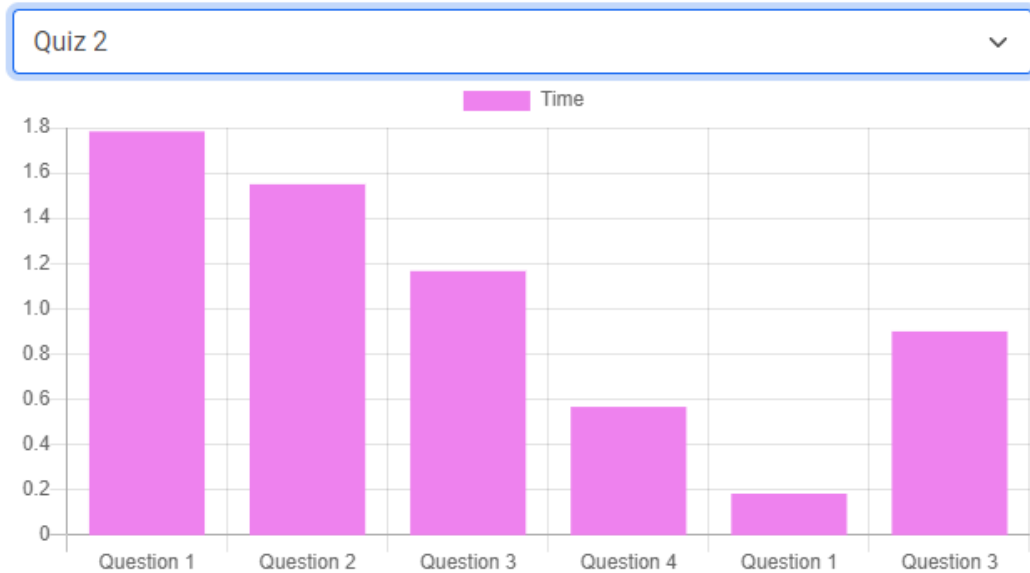|	Quiz 1	Quiz 2	Quiz 3	Quiz 4
Your Marks	75	100	100	50
Highest Mark	75	100	100	100

TELA Dashboard – Quiz Analytics

Your Current Status

81.25

TELA Dashboard − Quiz Analytics
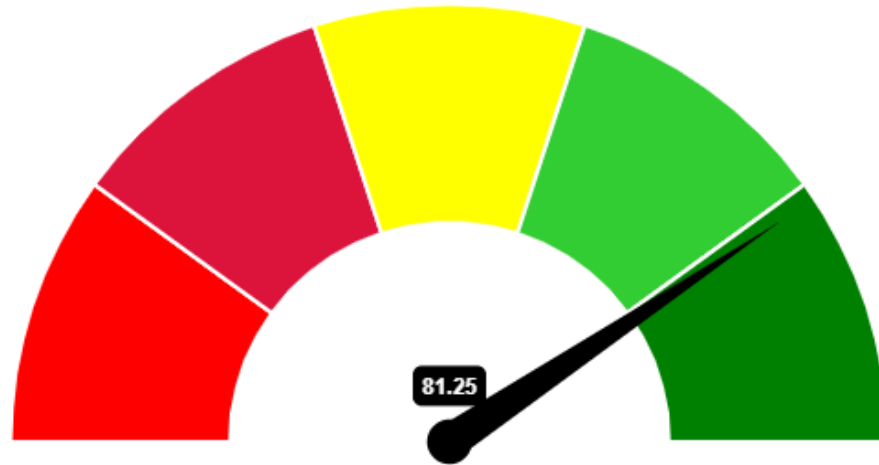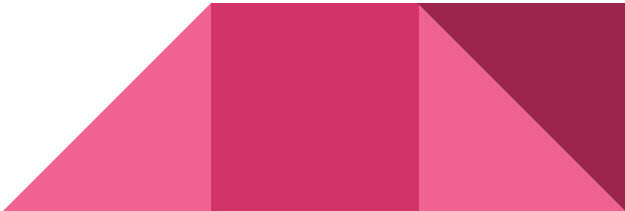
TELA Dashboard – Forum Analytics

Can the TELA system support the students to improve their motivation, interaction, self-confidence, and grades?

➢ We evaluated the TELA system by conducting user validation studies.

➢ We gave the system to 25 fourth-year undergraduate students of the UCSC and interviewed them to get their feedback about the TELA system.

➢ The interview was conducted for about 45 – 75 minutes with each student and evaluated each feature in the TELA system.

User Evaluation of the TELA System

Module	Feature	Highly Useful	Useful	Neutral	Not Useful
Access Analytics	Progress Bar	92%	8%		
	Resource Access Count	88%	12%		
	Daily Action Count	12%	40%	48%	
	Daily Action Count – All Courses	16%	64%	20%	
	Daily Online Time	48%	40%	12%	
	Time Spent for SCORM material	84%	12%	4%	
Quiz Analytics Module	Quiz Marks with Class Average	96%	4%		
	Quiz Marks with Class Highest Marks	92%	8%		
	Your Current Status	96%	4%		
	Quiz Time	64%	36%		
	Question Time	12%	40%	48%	
Forum Analytics	Forum Graph	72%	28%		

Overall System Evaluation			
Question		Yes	No
Do you think the TELA system will support you to improve your motivation?		100%	
Do you think the TELA system will support you in improving your engagement?		100%	
Do you think the TELA system will support you to improve your self-confidence?		100%	
Do you think the TELA system will support you in improving your grades?		100%	
Do you think the TEAL system will support you to conduct learning activities in situations like the COVID-19 pandemic period?		100%	

Experimental Research – TELA Dashboard

SCS3209 – Human Computer Interaction

[50 – Control group/ 50- Treatment group]

IS3102 – Human Computer Interaction

[25 – Control group/ 25- Treatment group]

Experimental Research – TELA Dashboard

H1 : TELA dashboard can improve the grades of the students

H2: TELA dashboard can improve the interaction of the students

Qualitative evaluation will be also conducted with the undergraduate students using interviews.

Future Research

➢ Design and implement a Technology Enhance Learning Analytic Dashboard for lecturers.

Thank you