

# Instructional Technology adoption at Higher Educational Institutions using Post-PC Technology

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**Executive Summary:** - “Technology is a driving force in education, opening up many doors and preparing students for what lies ahead, not behind,” said Kirsty Kelly, Primary Years Program Coordinator at the Canadian International School in Singapore.

Educational systems in the 21st century are affected by the massive accelerations in technology development. The practice of learning is now outside the classroom more than inside. The student in this system seeks fruitful learning where the skills are needed as the scientific value. Instructional Technology (IT) is an integrated system that prepares and evaluates the educational process to achieve the desired learning goals; this can be achieved by understanding local practice and using IT insights to design more attuned interventions (Hora & Holden (2013)). The proposed research aims to assess the impact of offering a range of affordances to instructors and students on the teaching and learning processes. The proposed pilot educational research is undertaken on a focus group with two instructors and approximately 40 IT students at UTAS-Suhar; to explore the use of Post-PC technologies for applying an interactive and customised curriculum and to add enhancement to the learning process and outcome.

Using the latest training/educational technologies enhances the effectiveness of learning environments. Therefore, this research studied the impact and outcomes of Instructional Technology (IT) adoption at Higher Educational Institutions (HEIs) using Post-PC Technologies. The research was planned to conduct an experiment on four groups of Information Technology majors, where two groups will apply IT, and the other two will use the traditional learning strategy. First, a pilot online survey was conducted with the two IT groups to collect data about their interest and expectations about the IT techniques. The survey results were used to examine how students' performance, success, and achievements are affected by using Post-PC Technology as per their responses.

Tableau data visualisation tool was used to analyse and visualise the collected data and compare the students' performance in 4 groups. This helps to emphasise the importance and impact of IT on students' learning process and achievements at HEIs.

## I. INTRODUCTION

Higher Education is a complex social mission which targets the use and allocation of a variety of learning resources such as qualified and experienced faculty, books and instructional technology tools to graduate valued and effective leaders in their chosen professions and communities. According to Ololube et al. I. (2009), to enhance information access and delivery to students and to gain rich learning outcomes, good and recent instructional technology has to be

applied besides the traditional way of teaching. This will improve the quality of the curriculum and provide a wide spectrum of means to encourage students to use technology to achieve their educational aims and objectives.

Clemes (2010) defined Instructional Technology (IT) as the use of technology in delivering instruction at an educational institution. It's a systematic procedure of designing, developing, employing, administrating and assessing the learning process. According to Nuri and Sevim (2013), Instructional Technology has named teaching machines used or instructional activities such as presenting information, mentoring and grading students' activities and work. This definition clarifies that instructional technology is a specific technology used to accommodate successful and effective learning technologies and patents in higher education.

Instructional Technology enhances educational experiences and skills and enables academic engagement and social participation by creating a more student-oriented learning environment (Nuri and Sevim (2013)). This supportive service benefits students overall and students with hidden disabilities. For example, students with diffidence and lack of self-confidence who do not ask questions or participate in the classroom. Also, students with learning disorders, shortage of searching skills, and deficiency in using and acknowledging applicable and available technology.

In addition, faculty and students need to increase and maximise their technical skills to help themselves and improve their abilities for distance learning. Sometimes, we get to situations where students must be taught online using some good remote work tools. For example, in 2019-2020, we experienced the Coronavirus (COVID-19) outbreak, where all educational institutions worldwide announced the suspension of study. This time the significance of IT is raised, where all educational institutions have to use e-learning tools to catch up with their students and continue the educational process. IT adaptation or rejection is influenced by the alignment among prior experience, goals, perceived affordances of specific tools, and cultural conventions of the disciplines (Hora & Holden (2013)).

Thus, meeting the challenge of technology, being ready for any task at any time, and providing critical support services will ensure and encourage students' access to e-learning. Also, this will enhance students' professional development. For instance, IT in HE will increase students' and faculty's abilities to process information differently, such as critical thinking, speaking,

problem-solving, reasoning and reporting outcomes. Besides, preparing professionals for implanting the competence for the use and design of current and emerging technologies.

## II. OBJECTIVES

This systematic research seeks to examine the impact and outcomes of the adoption of instructional technology on students' achievements and success at HEIs through the following objectives:

1. Develop a framework to identify and strengthen the understanding of the use and allocation of IT in different ways at HEIs.
2. Analyze the impact and outcomes of IT adoption on students' success and independence at HEIs.
3. Activate the effectiveness of participation among senders and receivers using technological means.
4. Diversify experiences presented to learners by engaging sight, audio, and critical thinking while using the IT methods.
5. Ensure continuous updates that guarantee greater effectiveness of the educational process.

The above objectives were associated with some hypothesis (H) that were tested once findings were reported:

- H1:** IT will increase students' performance in different ways and perspectives (i.e. typing skills, use of online services and tools, online storage drives, completing work effectively in less time and effort).
- H2:** Students will practice in theory classes for courses that are 80% practical; this will improve their learning process and help them gain a better course understanding.
- H3:** IT will enable and support students with critical thinking and problem-solving.
- H4:** Students will learn about different and recent software and hardware devices in the market. "Students will like IT adoption and develop new ideas for tools used in this research".
- H5:** The current learning environment is ready to adopt technological transformation using Instructional technologies.
- H6:** Post-PC technology facilitates a transition from seminar-based lecturers to inquiry-based learning.

## III. MATERIALS AND METHOD

### 3.1 Literature Review

Instructional Technology is a scientific study of instructional design and development that aims to create an engaging and effective learning environment at Higher Educational Institutions.

A study was conducted by Alasmari & Zhang (2019) to investigate college students' acceptance of mobile learning technology. Their findings indicate that the demand for

portable digital devices for learning will likely increase as they eliminate traditional time, space and geopolitics constraints.

Clemes et al. (2008) conducted a study to examine the impact of faculty technology literacy and technology training on the integration of instructional technology into higher education. They had an online web-based survey of anonymous faculty members of fifteen University of North Dakota peer institutions. They used single-stage random sampling, and the online survey link was sent via email to random anonymous participants, the population size was 1115, and the total number of respondents was 237. The reliability of their study was determined by using Cronbach's alpha statistic for the consistency of the scales. They had an online web-based survey of anonymous faculty members of fifteen University of North Dakota peer institutions. They used single-stage random sampling, and the online survey link was sent via email to random anonymous participants, the population size was 1115, and the total number of respondents was 237. The reliability of their study was determined by using Cronbach's alpha statistic for the consistency of the scales.

Technology training and faculty preferences for instruction style showed that more than 33.4% of surveyed faculty preferred to teach in a traditional classroom without integrating technology, and only 25% preferred to teach in a blended classroom. The reason for getting this result was related to the attendance of faculty members to the University-sponsored training, as only 7.2% of faculty claimed that they attended the training to a very great extent while the majority, 50.4%, attended the training to some extent. So, from this result, we can understand that if there is no interest or focus on the training, we cannot expect good outcomes from any training or workshop attendance.

In addition to faculty literacy and IT integration, Clemes et al., (2008) reported that another reason for not using IT most faculty members was that faculty training was not related to the integration of technology. That means that faculty members were neither trained nor instructed regarding the importance of IT and its use and implementation at HEIs. Also, according to the outcomes of the study, Clemes, et al., (2008) noted that the majority of faculty had proficiency in the integration of word processing software and websites, while a very less faculty had proficiency in creating and implementing learning-based websites to add breadth to courses and facilitate better student learning.

Therefore, an effective training strategy highlighting the significance of IT allocation at HEIs is an important step. IT adoption will improve and develop faculty technology literacy and support Instructional Technology and student learning technology. This development will enhance communication among students and instructors and incorporate digital learning objects.

The information and technical revolution profoundly impact intellectual communication, and it is reflected in the performance of higher education institutions. Researchers have

realised the importance of instructional technology in enhancing the educational process. Research has been conducted by (Zabar and Nasser, 2018) at the University of Babylon to assess the impact of the role of instructional technology on raising the level of global classification and the quality of education for Iraqi universities. They have found that the efficiency of using educational technology positively affects the quality of higher education in all its dimensions, such as the quality of the university professor, scientific research, education and curricula, and university libraries. They have found that the role of instructional technologies in improving the educational process in HEIs is developing an educational environment characterised by temporal and spatial flexibility.

Offering educational programs through instructional technology that gives students skills besides the scientific value leads to new areas of learning in which the university teacher is directed to the educational process, not communicating and transferring knowledge (Zabar and Nasser, 2018).

Moreover, lecturing is an example of adaptive instruction, which combines what lecturers know about the subject, practical instructions, and students. Lecturers might give hints or guide questions to stimulate a connection and dialogue about the topic; they may provide different examples and feedback based on students' strengths and weaknesses to assign remedial content or exercises. Thus, looking for attractive ways to replicate the benefits of tutoring in an adaptive instructional environment is a significant consideration for lecturers (Durlach and Spain (2014)).

Since much research has reported the significance of IT adaptation, and some have not explained the strategies and methods they used in their research, it is not clear what type of technologies (software and hardware) would have a remarkable impact and outcome on students' performance. Thus, this research indicates the significance of IT and clarifies which technologies result in increased academic and social satisfaction and performance at HEIs.

### 3.2 Research Methodology

The research will follow an explanatory research methodology:

#### 3.2.1 Secondary Research:

We followed the secondary research methodology as a research method to explore the existing data. It involves using the existing data to summarise the research problem's overall effectiveness. The systematic review considers one of the most frequent practices of secondary research. This section briefly reviews the available resources as the first step in designing the proposed research experiment.

##### 3.2.1.1 Literature Research:

- *The concept of Instructional technology.*

Relying on technologies in every field can undoubtedly show dramatic enhancement. Decades ago, at HEIs, we used to teach using projectors, slides and static material. Today academic

institutions can be considered the first fields to implement Post\_PC Technology and monitor their effectiveness. The following research plans to test how instructional technologies could improve HEI if fully applied. Instructional technology in "How Instructional Technology Can Improve the Learning Process" article is defined as "the theory and practice of using technology for education.". The method of using instructional technologies encompasses a systematic method with five main stages, as shown below.

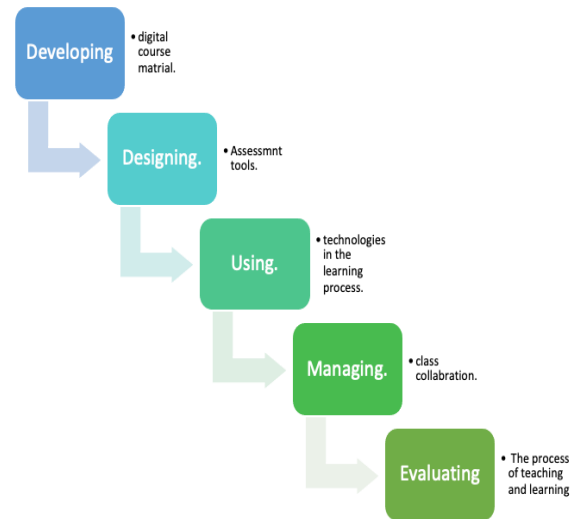


Figure 1: Instructional Technologies Systematic Method

The primary purpose of Instructional Technologies is to improve the effectiveness and efficiency of learning and teaching. It can create an interactive collaboration to extend the learning process beyond the actual classes.

- *The reflection on applying Instructional technologies in the learning process. What others have done using IT*

The actual implementation of the proposed research idea was affected by the acceleration of COVID-19 events. However, the research hypothesis was reached successfully. Lecturers and teachers worldwide were forced to use visual classes instead of physical classrooms. As Mr.Mohammed (2022) talked about the emergence of the teaching shift, "It was a sudden change, but it was a need". He mentioned in the interview made by the Co-PI that he touched on the effect of using IT in classrooms while creating his teaching videos and learning platform. It supports 21st-century skills. He acknowledged that IT provides finer access to information, a more comprehensive collaboration scope, and better meets diverse learners' needs.

#### 3.2.2 Primary Research:

To meet the research objective, the researchers needed first-hand information rather than relying on what is available in other publications. Primary research refers to research that involves the collection of original data specific to a particular research project (Gratton & Jones, 2010). To produce new knowledge, we conducted a self-administrated Online survey.

### 3.2.2.1 Online survey.

The initial dataset of this research was obtained by conducting a self-administrated online questionnaire distributed among anonymous students who have implemented the IT technique at the university; to collect data on students' interests and expectations. The online survey was divided into two parts, the first part involved scaling questions, and the second part involved three open questions; this to enable participants to add more value to the survey by providing helpful comments and valuable suggestions.

### 3.2.2.2 Population and Sample size

The population identifies the number of groups that we are interested in; sampling is a subset of the population that represents the population and participates in a study. The (population) number of survey participants was determined as a whole group, with 20 students having to participate (a total of 40 from 2 groups). We gained 30 responses, and these obtained samples were used to create the initial dataset for this project.

### 3.2.2.3 Data Preparation and Pre-processing

Data preparation is a vast subject which involves several explorations, iterations and analyses to achieve accurate and consistent results. Data has to be in a helpful format and scale and include meaningful features (Singhal and Jena, 2013). The technique used to refine a dataset to meet the requirements of examining a particular problem, such as removing noisy, irrelevant, inconsistent and redundant data.

Our dataset does not include any missing, inconsistent or noisy data, as we created the answers to survey questions to be required, so participants cannot submit the survey unless all questions are answered. All questions have a similar rating scale; each attribute has a unique name and belongs to a specific question. Therefore, the dataset of this project is complete and accurate data.

## IV. IMPLEMENTATION PLAN (TIME-LINE AND MILESTONES)

*Stage One: (0 - 4 months - Literature Review and Research Study)*

At this stage, the researchers will learn from the previous literature to prepare and report a well-designed field study plan for the spring semester. Also, the researchers will plan for the purchase of the instructional technology materials such as tabs and applications.

*Stage Two: (6-12 months - Material Purchase and IT Implementation in the Study Field)*

The required materials will be purchased, and the actual field study shall be conducted, where two different courses will be used, and each course will be divided into two groups with each researcher.

*Stage Three: (2-4 months - Data collection and preparation)*

At this stage, researchers will design and distribute the survey among the groups that implemented the IT, and then collected data will be analyzed, examined, and visualized using Tableau.

*Stage four: (4 Months – Results Analysis and Report Writing)*

Finally, the gained outcomes will be used to test hypotheses and acknowledge teaching experience and students' abilities. Also, the findings will support learning about the usability and impact of the different instructional technologies used on students' performance and achievements. Furthermore, according to the findings that we get, we will propose some recommendations and future work.

## V. RESULTS AND DISCUSSION

### 5.1 IT implementation in two groups:

Teaching and learning at higher education levels vary more than at schools. The main difference is flexibility. As figure 2 shows, the learning process can be summarised into four main components.

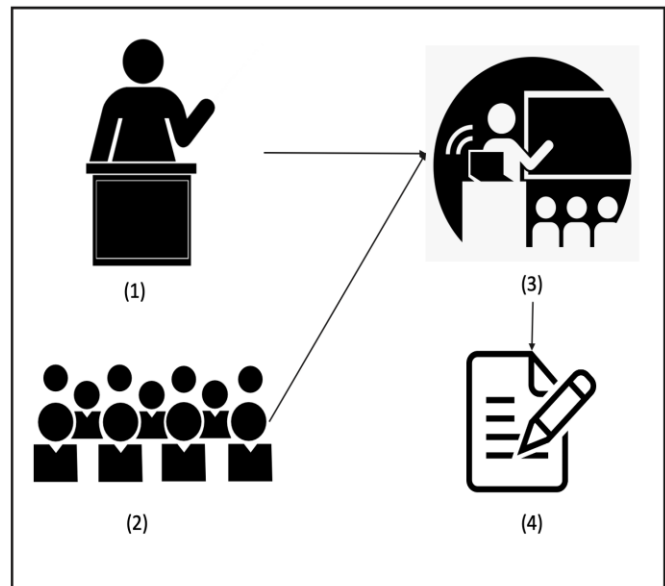


Figure 2: Learning Components

The learning process starts by combining educators with students in a classroom. The educator provides opportunities for students to learn. On regular days this happened by explaining the course material using a PC, projector, and whiteboard. Then examine the effectiveness of learning by conducting paper-based assessments such as quizzes, tests and assignments.

The described system was forced by the development of COVID-19 spreading to be shafted to virtual rooms and administered via technical communication channels. The educator used the virtual space to meet the students and deliver the class content. In the educational environment, synchronous and asynchronous modes were used, and the number of students

increased due to the absence of physical equipment. The limitation of physical contact also affected the last component of the learning process. In addition, Instead of conducting standard exams, online exams were used, and questions were limited to certain types restricted to the used assessment tool.

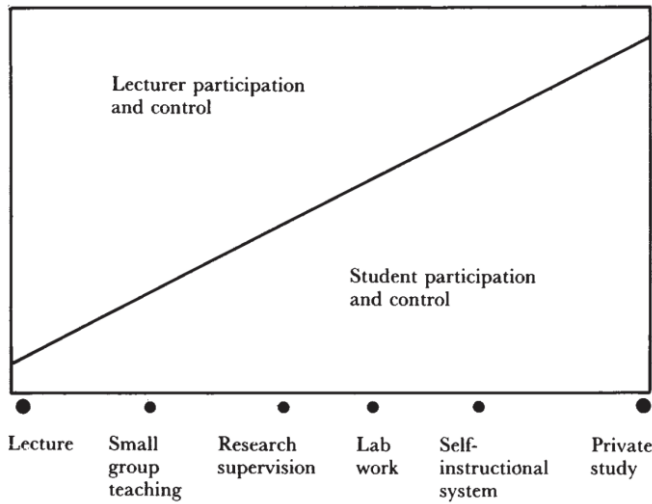


Figure 3: Teaching methods and Lecturer/Students participation

The above figure indicates the reflection of teaching methods and Lerner/educator involvement in the education process. As the session becomes smaller, student participation gets higher. However, using instructional technologies success in comping more than teaching methods at the same time.

5.2 Observe and visualise the results using Tableau.

From a point that assessment drives learning, researchers agreed on some indicators to examine the quality of teaching should be practical and reliable. Therefore, grades of two different courses delivered in two different semesters and modes were monitored and documented carefully. Tableau visualisation tool was selected to visualise and analyse the collected data.

5.3 Data Visualisation:

Data visualisation is an interesting interdisciplinary field that allows users to present organised, easy-to-understand and structured information in graphical representations. In this research, we used the Tableau data Visualisation tool which helps to create interactive charts and graphs as dashboards. Tableau is used to indicate and compare students' marks, engagement, classroom administration, feedback management, and assessment tools.

5.3.1 Students' Grade Analysis

Students' marks were analysed and compared using Tableau. The diagrams below show students' marks for two different courses in two different semesters, comparing marks between traditional classrooms vs online classrooms among four groups.

Figure 4 reflects a student's grade during the 20 spring semester for the course ITDR1 103. It was a fully online semester during

the pandemic. As shown, the grades were between A-, Bs and Cs.

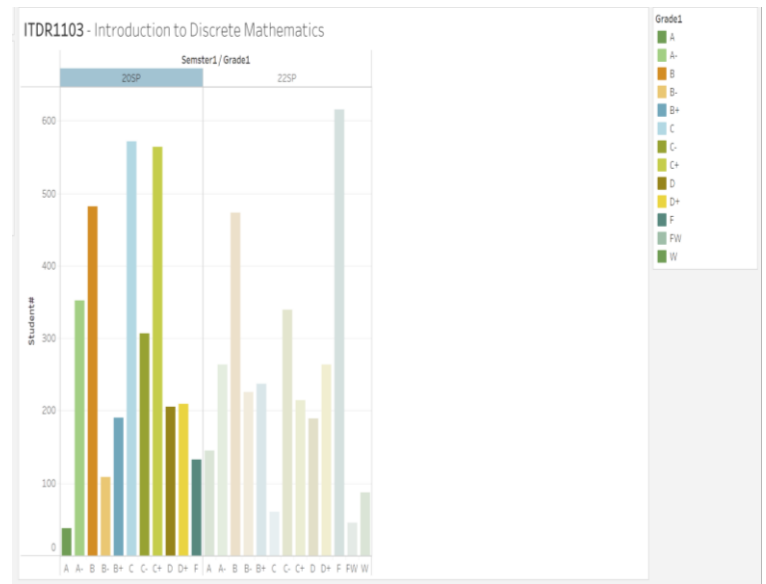


Figure 4: Students' Grades in ITDR1103 - 20 SP

2022 spring semester, get back to normal method, attending physician in a natural classroom and doing the paper-based assessment. Here a clear rise can be seen in the course falling.

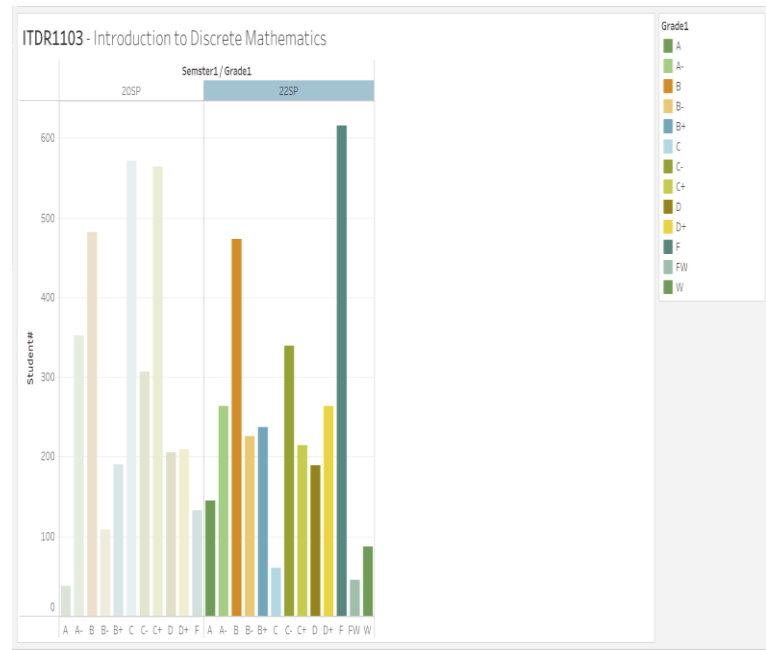


Figure 5: Students' Grades in ITDR1103 - 22SP

The experiment has also been conducted with another course. The ITDR2106 was delivered in the 2020 spring semester as an online class. Students' grades were centred between Bs and Cs. Moreover, the course did not experience falling cases. while in the 2022 spring semester, there is - the orange colour- a clear rise in the falling cases was found.

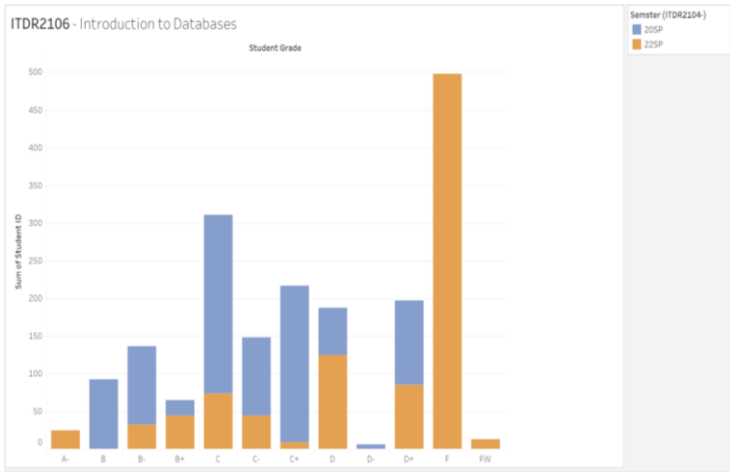


Figure 6: Students' Grades in ITDR2106 - 22 SP

We explored the impressive benefits of designing a framework to absorb the changing demands of the learning atmosphere. Instructional technologies showed a direct effect on evolving learner needs and expectations. The main findings are

1. The academic achievement of students has increased, and skills enhanced during digital and distance education.
2. There was a great improvement in students' engagement and collaboration in classrooms, and this was reflected by:
  - o Student engagement developed by using Instructional Technologies as it supports the various learning styles.
  - o Students were more committed to class attendance. By conducting online classes, we have noticed a drop in the absence ratio. This can be explained because the time and place of the class boundaries were eliminated.
  - o In information technology courses, there was an apparent shortage of practising the course material. as we were delivering theoretical and practical parts separately. By using instructional technologies no matter the place, learning methods can be combined.
3. Classrooms can be administered smoothly by using the functions of the virtual room. Passive classes by muting the participant, and active sessions by enabling screen display.

4. Instructional Technology helps in facilitating the effectiveness of instant feedback. Blackboard is the main portal tool used to manage the course material, announcements and assessments. With the distance learning shift, instructors and students experiment much more features than mentioned earlier.
5. Instructional Technology implementation in UTAS-Suar leads to the occurrence of new learning paradigms.

Table 1: Shift from Traditional to E-Learning

| From                                     | To  |
|--|---|
| Directed Teaching as teacher centred.    | Open learning process as Lerner centred.    |
| Passive modes of class instruction.      | Interactive mode of class instruction.      |
| Individual one-way information exchange. | Collaborative two-way information exchange. |
| Assessment of knowledge gained.          | Performance-based assessment.               |

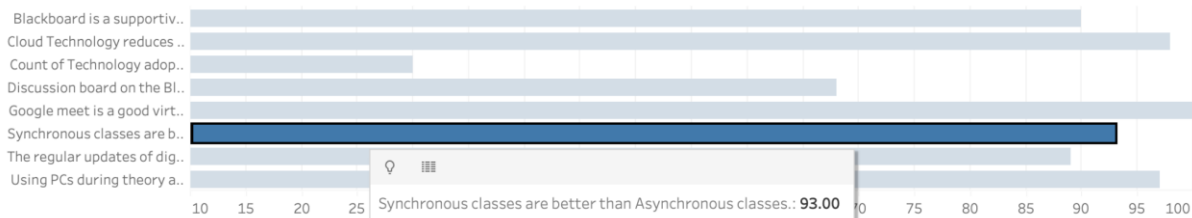
#### 5.4 Survey Analysis

The online survey responses are analysed on Tableau. The bar charts below indicate to what extent students are interested in the real implementation of applying Post\_PC Technology in both learning and teaching processes.

In terms of student engagement, we have found the following results:

- Above 90% of responses encouraged IT adoption; to create an effective learning environment and a good two-way interaction in classrooms. Also, students reported that synchronous classes are better than asynchronous classes.
- IT adoption will increase students' satisfaction and productivity; this will foster students' ability to learn and achieve their goals.
- Students' attendance and attention in online classes have increased more than in traditional classes.
- Students have used the discussion board to post answers, ask questions and comment on others' work and solutions via helpful feedback.

#### Post\_PC Technology



**Post\_PC Technology**

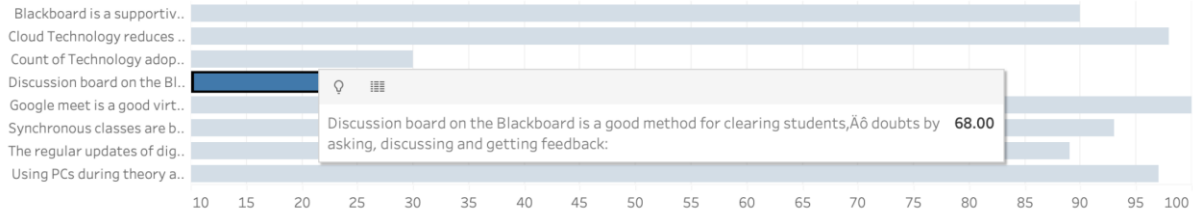


Figure 7: Students' Engagement in Classrooms

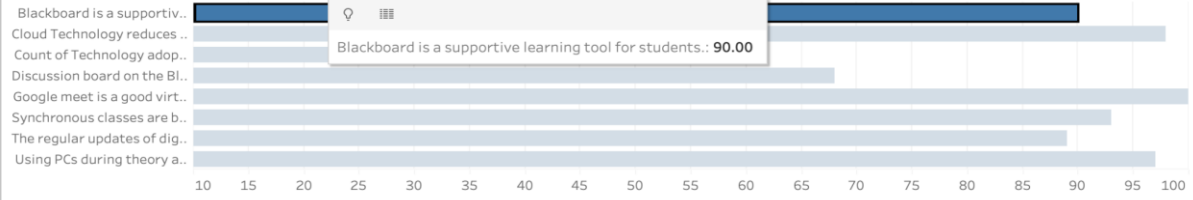
In terms of classroom administration, survey findings indicate the following:

- Students' are happy with the tools that we use for online teaching such as Google meeting, MS teams, Google Classroom, Bb, Emails, creating websites sharing synchronous and asynchronous classes links.
- Through AT adoption, we are able to share informative and educational links that students use to

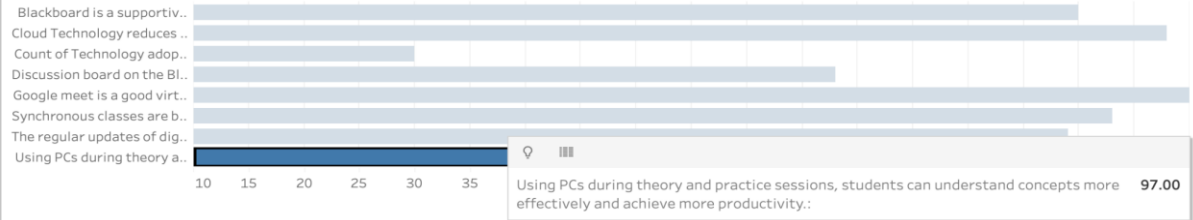
increase their practical skills and have some exercises/problems to solve.

- With the help of Post-PC Technology, students can share their screens, raise hands, use mice and chat, muting and unmute mice, using the camera. All these features are ways of interaction and collaboration between students and the lecturer.

**Post\_PC Technology**



**Post\_PC Technology**



**Post\_PC Technology**

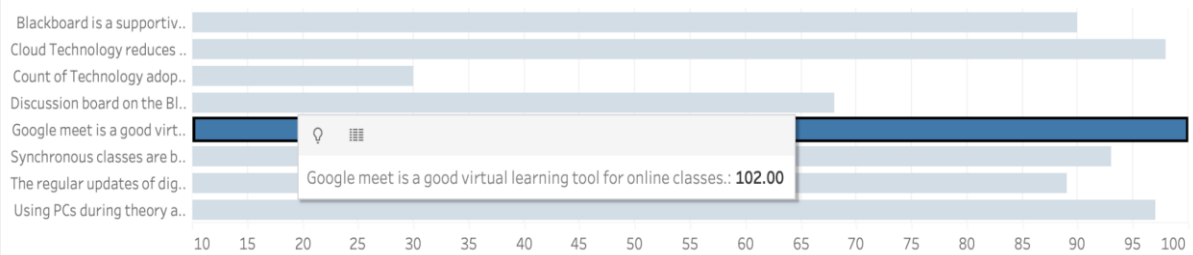


Figure 8: Classroom Administration

Regarding course assessments, the responses highlighted the following points:

- Online assessments are highly accepted and demanded by students, more than the traditional way of paper-based assessments. Students will get their

results immediately and know their mistakes and the correct answers for them.

Overall, students highly demand the use of Post-PC Technology in the teaching process; to increase students' ability to use technology, support required skills, practice while learning, and check websites for extra information and ways of

solutions. In addition, spending valuable student lesson time on using technology rather than just learning to use it, increase productivity in a short period of time with less effort.

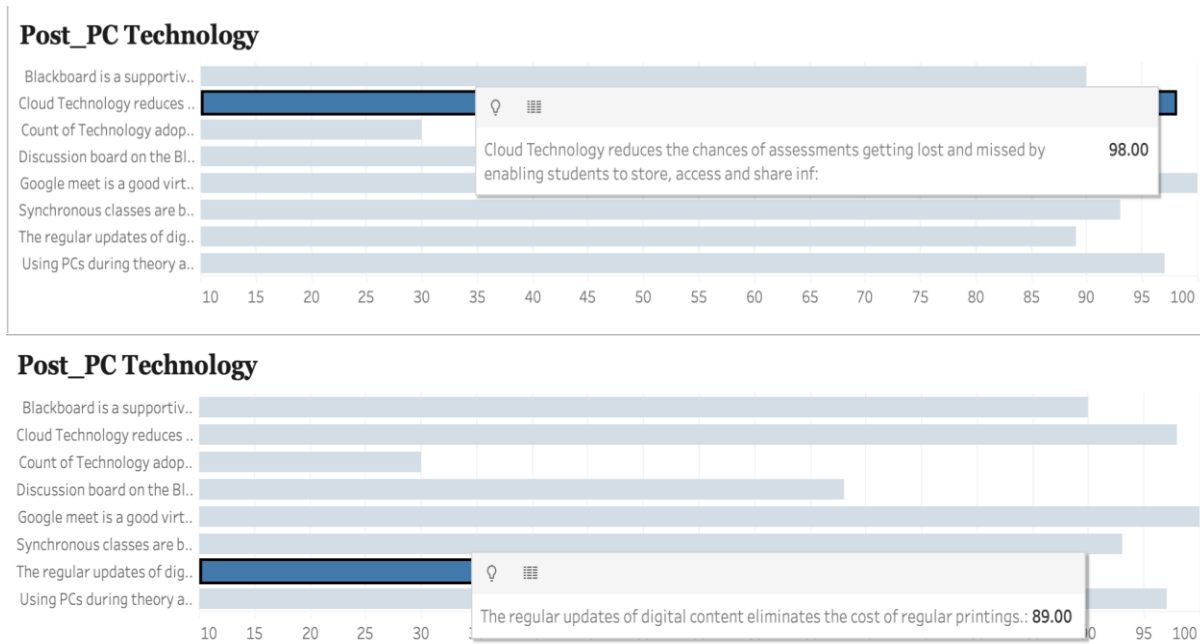


Figure 9: Post-PC Technology Adaptation Benefits

The figure below indicates students’ suggestions on methodologies for implementing Post-PC Technology at HEIs. The findings show that students prefer group assessments instead of individual assessments. Also, teaching has to be interactive and practical by using a pen in all ways. In addition, students are willing to have online assessments such as quizzes

and midterm/final exams are more effective and acceptable than traditional ways of paper-based assessments. Also, the most type of accepted questions in assessments is the MCQs and short answer questions. These results show that IT adoption was a successful plan, and it plays a critical role in motivating students toward higher levels of educational satisfaction.

**Descriptive Questions**

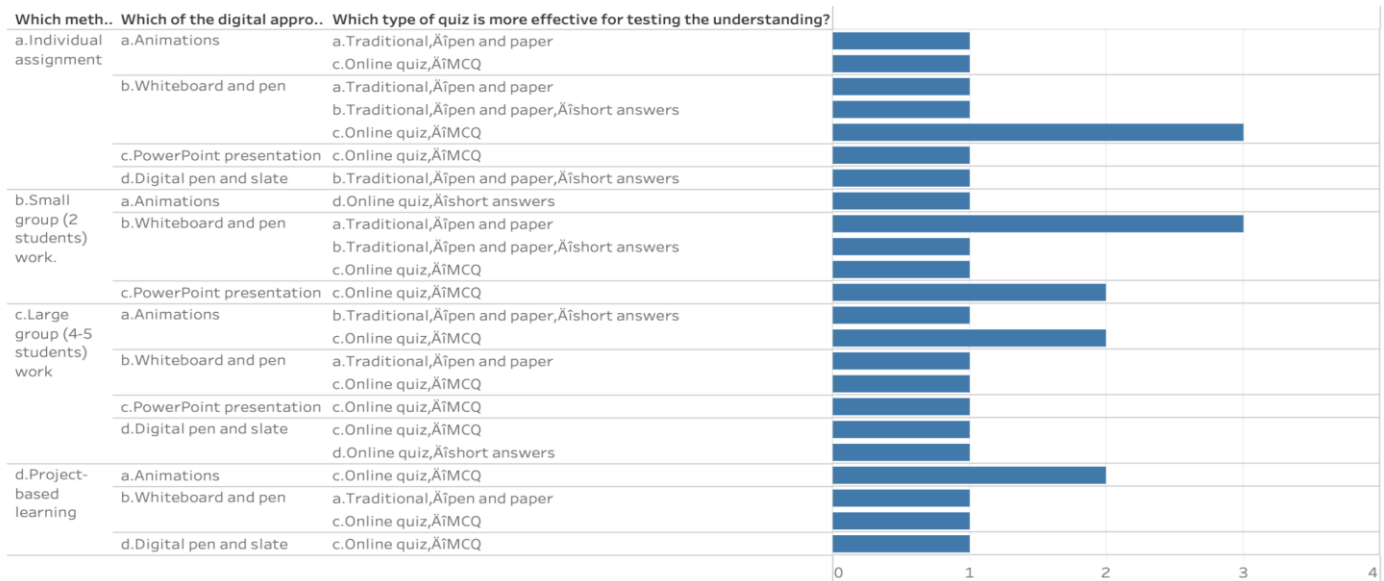


Figure 10: Types of Assessments



## VI. ACHIEVEMENTS

1. Our findings point out that our hypotheses have been achieved successfully. Students adopted IT by applying online data storage rather than physical drives, enhancing technology use and typing skills, thus increasing productivity. In addition, students' participation and grades indicate gaining a clear and better understanding of courses, where students had the chance to practice even during theory classes. These raise students' critical thinking and problem-solving skills and experiences.
2. Attending workshops on Technology Adoption
3. Interviewing and extracting knowledge from experts to gain deeper information on the use and implementation of Post\_PC Technology
4. Achieving our research aims and objectives successfully.
5. Exploring ideas on how this can be improved as a future work.

## VII. CONCLUSION

Higher education is rapidly increasing worldwide, and aims to maximise the commercial advantage and increase the universities' reputation in the competitive market to graduate students with high levels of technical skills and experience, attracting students' engagement, As discussed earlier in this paper, many studies have been conducted to examine the impact of instructional technology adoption at Heis; however, no such a study was conducted at UTAS campuses. Hence, this research aimed to examine the overall level of students' expectations and interests in adapting IT in lecturing and learning, acknowledge the factors that influence students' satisfaction, and propose recommendations.

Although there was a change in our plan because of the pandemic, which shifted the teaching to virtual rooms, our aims and objectives of this project have been achieved successfully. We reviewed and evaluated existing studies measuring which technologies enhance students' performance and create a collaborative learning environment; nothing was much evident. Thus, we planned to fill this gap by indicating the best technologies that students like and cooperate with.

A self-administered questionnaire was created to study the factors of students' interests. Students' grades were used to assess the impact of applying Post-PC Technology on students' performance and interaction. Tableau's mainstream data visualisation tool was used for analysis and data visualisation purposes to add excitement and interaction to our survey data.

Our findings indicate that students are interested in and highly welcome the adoption of IT via the use of Post\_PC Technology; this creates an effective learning environment with lots of collaboration and enthusiasm. Students' grades, attendance, class participation, online discussions, critical thinking, and problem-solving ideas show how students' are changing rapidly along with technology. We have acknowledged what

technologies students like to be implemented and how we can improve the learning experience and students' satisfaction.

Finally, our findings point out that our hypotheses have been achieved successfully. Students adopted IT by applying online data storage rather than physical drives, enhancing technology use and typing skills, thus increasing productivity. In addition, students' participation and grades indicate gaining a clear and better understanding of courses, where students had the chance to practice even during theory classes. These raise students' critical thinking and problem-solving skills and experiences.

## VIII. RECOMMENDATIONS

As students in the current era are considered native digital users, we highly recommend creating a website titled "Practice & Skill up your knowledge" That will support the students in higher-level education to experience their knowledge, creativity, critical thinking, a high percentage of imagination, and problem-solving skills. We also recommend increasing the investments in instructional technology tools to engage students in the learning practice. Furthermore, from this research findings, providing the necessary instructional technology training for educators will help integrate within their specific content area.

On the one hand, to accelerate 21st century skills in our students, we recommend providing the necessary environment to stimulate teachers to continue to strain technical skills and apply technology to enhance student learning practice. On the other hand, learners must have sufficient background knowledge and skills in the latest technologies, learning challenges, competitions, and working life experiences locally and globally.

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