Hong Kong Students' Perception of Providing Students with Digital Learning Materials Improves Learning Experience

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Abstract
This paper explores the impact of digital learning materials on improving student learning experiences in Hong Kong after the COVID-19 pandemic. A survey of 121 respondents was conducted to study students' perceptions towards Digital Learning Materials (DLM). The Technology Acceptance Model (TAM) guided the questionnaire survey. After collecting data, it was analysed that age, gender and education level do not influence students' perception of DLM. However, grade differences in tertiary studies and other external factors strongly influence students' perceived ease of use (PEOU) and perceived usefulness (PU). Other factors among TAM were also found to influence one another.
Keywords: Digital Learning Model (DLM), Technology Acceptance Model (TAM), Hong Kong Education

1. Introduction

The rise of new teaching methods in the Hong Kong education system, such as online learning materials, has allowed students opportunities to study smoothly at home. However, many crises have been discovered, such as students' concentration, learning engagement, and understanding are different from past education. The study aims to investigate Hong Kong students' perception of providing Digital Learning Materials (DLM) and categorise them by education level, gender, age, experience and learning habits.

2. Literature Review

2.1 Digital Learning Material (DLM)

Digital Learning Material (DLM) is a digitised and designed material for educational purposes and can be accessed using a computer. It originates from the word Learning Material (LM), a material for educational purposes. DLM may include, but is not restricted to, the following contents:

1. Drill and Practice: Provides consolidation and repetition of knowledge, trains and automates skills. Can build the confidence of learners through scores and results.
2. Tutorial: Provides predefined programs for learners to build up knowledge and skills. Relates to the knowledge application method or procedure.
3. Multimedia: Contains multiple types of material composition, such as text, images, sound, video and interactivity. It can be divided into linear content, which does not require the learner to control, and non-linear content, which controls progress by learner interactivity.
4. Simulations: Model of a system. Provide operations under different variables, allow changing values and understand the impacts of variables. Reduce dangerous or time-consuming situations while maintaining high-quality simulations.
5. Educational Games: Enhance interest in teaching content and motivate learners through diversified game content.
6. Autonomous Learning: Learners are responsible for their own learning. Learners must establish and implement personal education plans and make decisions based on needs, preferences or goals. Learning attitudes are important, and are expected to learn consciously and actively.

2.2 Measure of Students' Perceptions on DLM

2.2.1 Theory of Planned Behaviour (TPB)

Theory of Planned Behaviour (TPB) is developed based on Theory of Reasoned Action (TRA) (Fishbein & Ajzen, 1975), which demonstrates the evaluation of behaviour (attitude), perception of surrounding wanting the occurrence of a behaviour (subjective norms). It positively affects the behavioural intention, the main predictor of behaviour, through a behavioural decision model by Ajzen (1991). TPB assumes that human beings are rational and systematically use information available to them. (Ajzen & Fishbein, 1980) It also includes "perceived behavioural control", an extra component that refers to people's perception of difficulty in performing behaviour of interest (Ajzen, 1991). Atkinson's Theory of Achievement Motivation (1964) also points out that expectancy of success has "incentive value" to improve the behavioural intention.

2.2.2 Technology Acceptance Model (TAM)

The Technology Acceptance Model (TAM) is proposed as an information systems theory (Davis, 1989) and a model grounded in social psychology theory and TRA. While TRA points out that beliefs influence attitudes, TAM points out that a system is a response through the reasoning of user motivations, external stimulus of the system's features and capabilities. (Davis, 1985) The original TAM includes the perceived usefulness (PU), perceived ease of use (PEOU), Behavioural Intention (BI) and Student Attitude (ATT). Studies such as Adams et al. (1992), Davis (1985, 1989), and Taylor & Todd (1995) extend the TAM to include gender and age.

2.2.3 Perceived Usefulness (PU) and Perceived Ease of Use (PEOU)

Perceived Usefulness (PU) refers to the degree to which an individual believes a particular system would enhance job performance. On the other hand, Perceived Ease of Use (PEOU) refers to the degree to which an individual believes that using a particular system would be free of physical and mental effort. (Davis, 1989) Both are important in predicting a person's behaviour, especially PEOU, which predicts innovation adoption and system usage behaviour through beliefs of the efforts required to use a system. (Davis, 1985)

2.2.4 Technology Factors (TF)

Technology Factors (TF) represent student satisfaction with technology and the information quality of DLM. It includes the interface and system characteristics to assess the system's ability to address the business needs and the degree to which technology meets performance. (Dishaw & Strong, 1999; Delone & McLean, 2003; Wixom & Todd, 2005; Seddon, 1997) It emphasizes learning distinct knowledge and new technologies of computers and networks, with digital tools to promote the ability to use information technology. (Shin et al., 2011) High quality also improves users' ability to use technology, resulting in convenience and a boost in performance.

2.2.5 Student Factors (SF)

Student Factors (SF) refers to the technology experience satisfaction and eagerness to use it. Breckler and Wiggins (1991) defined attitude as "acquiring and enduring non-verbal features of the social and physical world through experience, exerting a direct influence on behaviours". Students' attitudes, such as eagerness and satisfaction, are based on experience and can trigger a positive perception of systems' value. (Baki et al., 2018) It also suggests that the enjoyable experience of the platform will influence the students. (Zhou et al., 2022)

2.2.6 Teacher Factors (TeacherF)

Teachers' attitudes towards DLM influence students' satisfaction through timely response, assistance to encourage continued learning when facing problems or trouble. (Arbaugh, 2002; Thurmond et al., 2002) The instructor also plays a significant role in explaining knowledge and theories in DLM through appropriate instructional media. Their ideas will be transmitted with optimization results. (Yang et al., 2014) Hong et al. (2021) also showed that teachers are more inclined toward education technology. Therefore, the attitudes towards DLM can be an important measurement indicator.

2.3 Research Hypotheses

The following hypotheses are presented to demonstrate the relationships between different variables as guided by frameworks and designs:

2.3.1 Gender Difference

Research indicates that males are more likely to be more advanced, capable and interested in handling high-level ICT skills or computer-related activities than females. (Broos, 2005; Dumont et al, 2010; Arnseth, 2006) As males are more confident in using computers than females (Keller, 2010), males are more likely to believe that they can handle DLM more easily than females (PEOU), leading them to have a greater chance of performing better than females (PU).

H1: PU of DLM is different between genders
H2: PEOU of DLM is different between genders

2.3.2 Age Difference
Age is an important demographic variable in behavioural intention, adoption and acceptance of technology (Chung et al, 2010; Porter & Donthu, 2006; King & He, 2006). It is believed that senior students have more experience in using technology, thus influencing their ability to learn a new software application (Morris & Venkatesh, 2000).
H3: Age has a positive effect on PU of DLM
H4: Age has a positive effect on PEOU of DLM

2.3.3 Education Level Difference
Education level affects the relationship between main determinants and behavioural intention (Burton-Jones & Hubona, 2006). It affects the individual's knowledge and skill, thus affecting the behavioural beliefs (PU and PEOU) towards acceptance and usage of new technologies (Rogers, 2003; Agrawal & Prasad, 1999).
H5: Education level has a positive effect on PU of DLM
H6: Education level has a positive effect on PEOU of DLM
H7: Higher grade in tertiary education has a positive effect on PU of DLM
H8: Higher grade in tertiary education has a positive effect on PEOU of DLM

2.3.4 Technology Factors (TF)
As mentioned on 2.2.4, the system or information quality addresses the business needs of higher technology quality to improve students' work performance (Dishaw & Strong, 1999; Delone & McLean, 2003; Wixom & Todd, 2005; Seddon, 1997).
H9: TF has a positive effect on PU of DLM
H10: TF has a positive effect on PEOU of DLM

2.3.5 Student Factors (SF)
Satisfaction with experience and eagerness to use technology enhances confidence and creates a positive attitude in using DLM. It relieves stress and eases the process of using DLM.
H11: SF has a positive effect on PU of DLM
H12: SF has a positive effect on PEOU of DLM

2.3.6 Teacher Factors (TeacherF)
Teachers having a positive attitude toward DLM will provide more assistance to students, reducing students' perceived difficulty in using DLM.
H13: TeacherF has a positive effect on PU of DLM
H14: TeacherF has a positive effect on PEOU of DLM

2.3.7 TAM Variables
TAM, which serves as a baseline model to guide the study, shows the relationship between PU, PEOU, BI and ATT. It is considered the most influential and commonly employed theory for describing an individual's acceptance of information. As explained in 2.2.3, PU and PEOU refer to different degrees of student beliefs. PEOU is believed to show a statistically positive effect on PU. (Han & Sa, 2021) BI refers to the actual use of DLM, thus determining DLM acceptance, while ATT refers to students' attitude toward DLM usage. Higher PEOU influences student thoughts on DLM, increases efficiency and saves time in student perceivedness, thus enhancing student engagement with DLM. Beliefs about system-enhancing job performance allow the activeness of DLM usage. It also persuades students to put in effort, affecting PEOU.
H15: PEOU has a positive effect on PU of DLM
H16: PEOU has a positive effect on ATT of DLM
H17: PU has a positive effect on ATT of DLM
H18: PU has a positive effect on BI of DLM
H19: ATT has a positive effect on BI of DLM

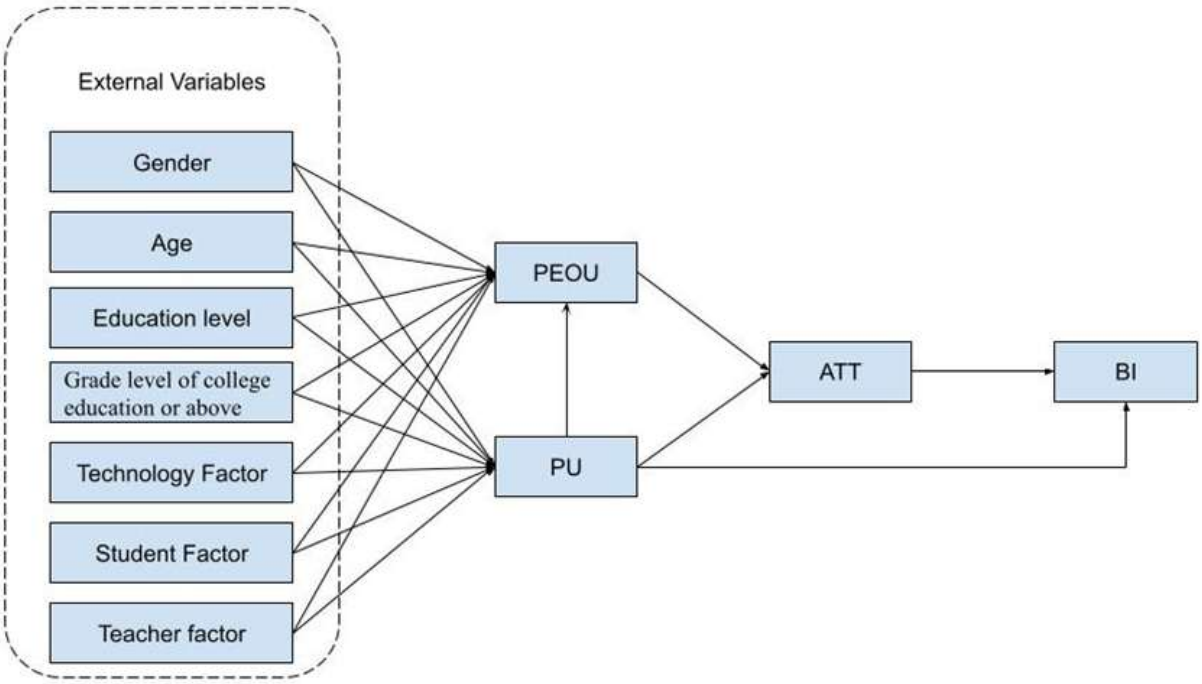


Fig 2.3.7: Research Model of Students' Perception in DLM in Hong Kong

3. Methodology

3.1 Research Design

Data is collected through Web Questionnaire Surveys to evaluate Hong Kong students' perception of providing DLM. The survey is based on a large first-year Health Science course (Daniel & Bird, 2019), which collects data on interviewees' digital content, teaching methods, and students' participation in content, peers and lecturers. This method allows extensive data collection in a short period of time for analysis. The questionnaire is distributed and collected from different respondents through the Internet.

The study consists of 5 main stages:

1. Planning – Identify the target population
2. Sampling – Determine the study sample of the target population
3. Questionnaire Survey Design – Design and develop the questionnaire survey
4. Questionnaire Survey Distribution – Distribute the survey, then collect the results and administer the survey
5. Data Analysis – Use the collected survey data to conduct an analysis and report the results

3.2 Advantages and Disadvantages of Web Questionnaire Surveys

Web Questionnaire Surveys have advantages over other data-collection methods, such as interviews (Bowling, 2002; Denscombe, 2003). It allows the researcher to:

1. Collect large and diverse data by reaching various individuals, including hard-to-reach samples. Collected data can be categorised by interests, attitudes, beliefs and values.
2. Protect both the researcher's and participants' personal safety as the research is conducted during the COVID-19 pandemic.
3. Increase anonymity, especially when raising sensitive issues, which increases data reliability and respondents' sense of security.
4. Reduce time to collect data from respondents.
5. Provide participants with flexibility, such as the venue and time period, when filling out the questionnaire.
6. Reducing the cost of paper, printing and postage.

However, there are also disadvantages to Web Questionnaire Surveys. The following addressed them with overcoming methods:

1. Lack of interactivity compared to face-to-face or telephone surveys, as it is based on textual questions. No immediate responses from the researcher to the respondents led to different respondents having

different interpretations of the same question, making the results subjective due to misunderstanding or confusion of the questions. Simple wording and questions are used to overcome such problems.
2. Unable to observe facial expressions, body language or tone of voice, resulting in losing valuable data such as emotions and other subtle features. To overcome such problems, Likert scale questions are used to collect emotion data through a scale from “absolutely agree” to "absolutely disagree”, providing a larger scope for trend analysis.

3.3 Questionnaire Survey Design

The questionnaire survey is split into 3 parts:

1. Respondent Characteristics – Inquire personal information such as education level, gender, age and usage of DLM in their course. It allows researchers to understand and distinguish situations or control factors.
2. Student Habits in DLM – Collect and compare DLM habits of different respondents, including the number and time of DLM usage and the type of LM provided in the course.
3. Students’ Perceptions and Behaviours of DLM – Collect TF, SF, TeacherF, PU, PEOU and BI using the Likert scale.

3.3 Distribution and Collection of Web Questionnaire Surveys

In the early stages of the research, 10 copies were distributed to peers and colleagues for feedback and opinions, such as word choice and design perception. It also serves as a proofreading process and a test run of the operational flow. Since the process is smooth, the research extended the sample to Hong Kong students from different academic qualifications and colleges through snowball sampling. The questionnaire survey was also distributed through social media such as Facebook, Instagram and X to prevent the echo chamber effect and eliminate the issue of paid survey participants. As the survey was not conducted for community purposes, the response rate achieved 85.21% with 142 questionnaires distributed.

3.4 Data Preparation and Analysis

Data management is conducted to check if the questionnaire is answered thoroughly and suitable to be used as an analysis sample. To ease the process, raw data was imported into Excel to facilitate data analysis. After data management, the Statistical Package for Social Science (SPSS) is used to analyse the data and the relationship between different causes. The following are the data analysed:

1. Data Validity – The degree to which the questionnaire surveys can measure the intended purpose through factor loading and item-total correlations between items.
2. Data Reliability – The consistency of the measure (questionnaire) represented by Cronbach’s Alpha (α). Calculated through the number of items and the average cross-correlation between items. Acceptable value is 0.7 (Fornell & Lacker, 1981)
3. Factor Analysis – The degree of the relationship between different groups of questions refers to factors, such as situation and IQ. Acceptable value is above 0.3 (Fornell & Lacker, 1981)
4. Independent-samples T-test – Comparing means of two independent data groups to determine the difference in related population means
5. One-way ANOVA – Use for determining the difference between the means of 3 or more independent groups
6. One-sample T Test – Use for comparing the variable mean and a hypothetical value to determine whether there is a relationship between two different variables (Allen, 2017)

3.5 Validation of Measurement Scale

3.5.1 Factor Analysis

The extractions of items during the factor loading of the measurement scale are above 0.3, while the corrected item-total correlation of the measurements is also bigger than 0.3. This indicates that all questionnaire items are sufficiently related to a given factor. Therefore, the data were reliable, and the items had a significant variance for factor analysis.

3.5.2 Component Analysis

Table 1: Component Analysis for Factors

Construct	Components Extracted	Variance Explained, % (Component 1, Component 2)
Technology Factors (TF)	1	50.888
Student Factors (SF)	1	49.760
Perceived Usefulness (PU)	1	68.907
Perceived Ease of Use (PEOU)	1	69.361
Attitude (ATT)	1	59.109
Behavioural Intention (BI)	1	56.856
Teacher Factors (TeacherF)	2	49.743, 18.706

Principal Component Analysis (PCA) validated the survey's measurements by identifying underlying components for each construct. A component is extracted from TF (50.89%), SF (49.76%), PU (68.91%), PEOU (69.36%), ATT (59.11%), and BI (56.86%). Two components are extracted from TeacherF (49.74% and 18.71% variance). Component 1 was prioritized as having higher variance explained, confirming scale suitability for future analysis.

3.5.3 Reliability Analysis

Table 2: Reliability Statistics for Factors

Item	Cronbach's Alpha	N of Items	Notes
Technology Factor (TF)	.839	7	All correlations > 0.3
Student Factor (SF)	.849	8	All correlations > 0.3
Perceived Usefulness (PU)	.885	5	All correlations > 0.3
Perceived Ease of Use (PEOU)	.887	5	All correlations > 0.3
Attitude (ATT)	.856	6	All correlations > 0.3
Behavioural Intention (BI)	.743	4	All correlations > 0.3
Teacher Factor (TeacherF)	.792	6	All correlations > 0.3

All factors have their Cronbach's Alpha higher than the acceptable value of 0.7 (Fornell & Lacker, 1981).

4. Analysis & Discussion

Data analysis is conducted based on 3.4, which follows the steps below:

1. Expound information and divide into subgroups based on part 1 in 3.3
2. Introduce descriptive statistics of the scale and summarized according to different factors
3. Conduct a sample t-test to compare the gender, education level and prior experience.
4. Conduct the one-way ANOVA to compare the gender and education level.
5. Analyse the Pearson correlation among factors
6. Discussion

4.1 Demographic Information

A total of 121 respondents answered 8 multiple-choice questions. All of the respondents indicated that they studied an education program in Hong Kong, and 99.2% of them indicated that their course had provided DLM. The following diagrams were the demographic background of the respondents:

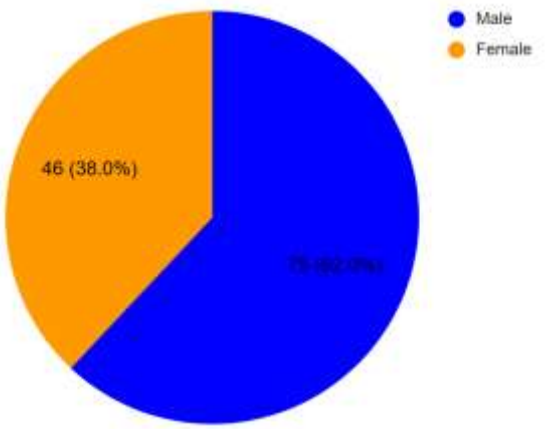


Figure 1: Respondents' Gender Distribution

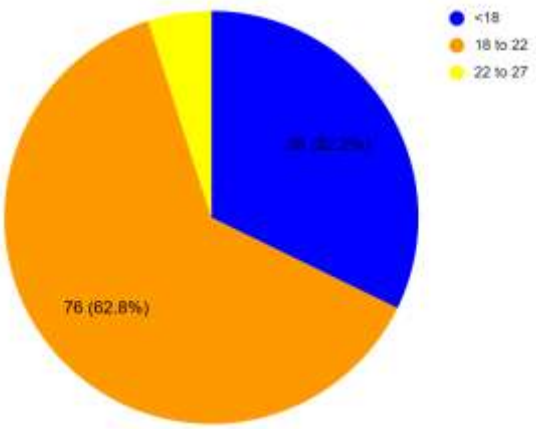


Figure 2: Respondents' Age Distribution

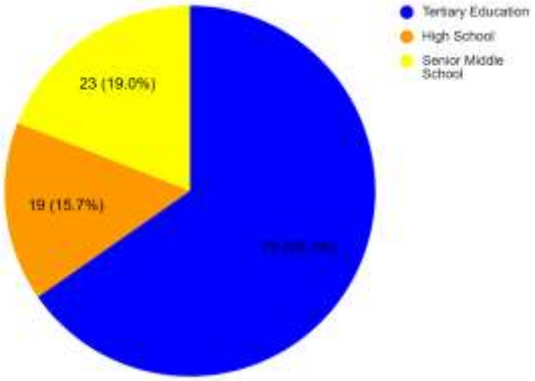


Figure 3: Respondents' Education Level Distribution

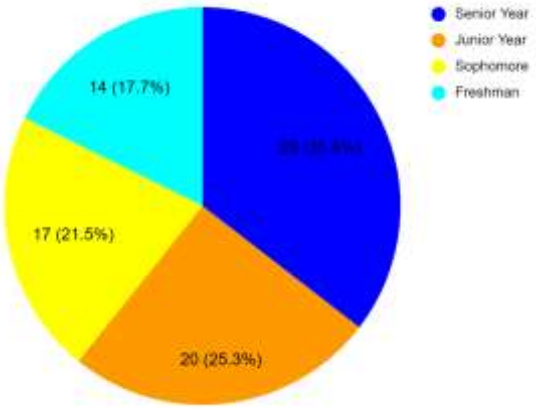


Figure 4: Tertiary Studies Distribution

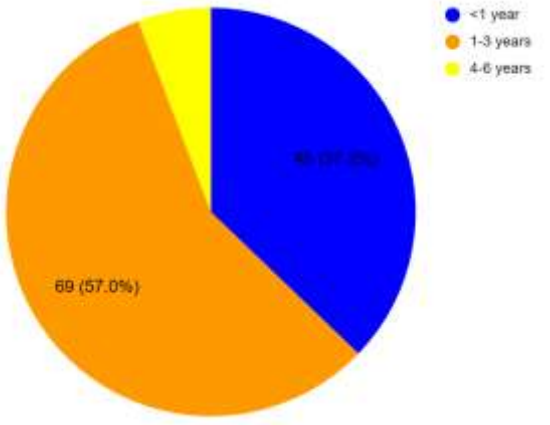


Figure 5: Respondents' Experience in using DLM

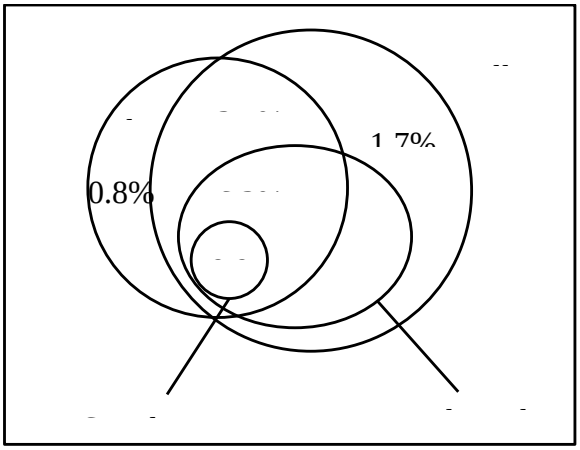


Figure 6: Venn Diagram of LM type

4.2 Descriptive Statistics

A total of 41 Likert scales (Questions 9 to 49) were provided. (1= absolutely disagree to 5= absolutely agree).

4.2.1 Technology Factors (TF)

From questions 9 to 15, TF was measured with a mean of 4.0850. This shows that respondents have a positive response to this factor, believing that DLM contains good technology and information quality. Among the questions, respondents highly identified that DLM helped record key points and make notes, as it has the highest mean.

4.2.2 Student Factors (SF)
From questions 16 to 23, SF was measured with a mean of 3.8523. This shows that respondents have a positive response to this factor, agreeing that they are satisfied and eager to use DLM. Among the questions, respondents felt DLM helped them in preparing lessons as it had the highest mean.

4.2.3 Perceived Usefulness (PU)
From questions 24 to 28, PU was measured with a mean of 4.0033. This shows that respondents have a positive response to this factor, presenting the belief that DLM enhanced respondents' performance. Among the questions, most respondents agreed that DLM enhanced their effectiveness in learning, as it had the highest mean.

4.2.4 Perceived Ease of Use (PEOU)
From questions 29 to 33, PEOU was measured with a mean of 4.2496. This shows that respondents have a positive response to this factor, being confident that DLM would be free from effort. Among the questions, respondents indicate that it is easy when learning to use technologies in DLM, as it has the highest mean.

4.2.5 Attitude (ATT)
From questions 34 to 39, ATT was measured with a mean of 4.0510. This shows that respondents have a positive response to this factor. Among the questions, most said that DLM has a positive impact on learning awareness, as it has the highest mean.

4.2.6 Behavioural Intention (BI)
From questions 40 to 43, BI was measured with a mean of 3.9318. This shows that respondents have a positive response to this factor, indicating that respondents are most likely using DLM. Among the questions, most respondents think that Hong Kong education should develop DLM as it has the highest mean.

4.2.7 Teacher Factors (TeacherF)
From questions 44 to 49, TeacherF was measured with a mean of 4.0000. This shows that respondents have a positive response to this factor, indicating that teachers use DLM in a good way. Among the questions, most respondents revealed that teachers will accept opinions when encountering difficulties in DLM, as it has the highest mean.

4.3 Independent Samples T-test
To find statistical significance, an independent samples T-test was used to compare related observations. It consists of 2 parts in the study:

1. Levene's Test for Equality of Variances – an inferential statistic used to assess whether the variances of two or more variables are equal. A p-value is observed (<0.05), and the null hypothesis is rejected as the probability of obtaining sample variances was low.
2. t-test for Equality of Means – Determine whether two different populations' means are equal. If the significance is less than or equal to 0.05, there is a significant difference between the two means.

4.3.1 Comparison of PU of DLM between Genders
Based on the items in 4.3, the values are 0.566 and 0.116, each value greater than 0.05. This indicates that the probability of obtaining differences in sample variances was high, and there is no significant difference in PU between different genders. Based on the results, hypothesis **H1: PU of DLM is different between genders** is rejected.

4.3.2 Comparison of PEOU of DLM between Genders
Based on the items in 4.3, the values are 0.451 and 0.122, each value greater than 0.05. This indicates that the probability of obtaining differences in sample variances was high, and there is no significant difference in PU between different genders. Based on the results, the hypothesis **H2: PEOU of DLM is different between genders** is rejected.

4.4 One-way ANOVA
Although one-way ANOVA cannot show which specific groups were statistically different, it is used to determine the significant difference between the means of two or more independent groups. If the p-value is less than 0.5, there is a significant difference in the mean of different groups, which will then require a follow-up by a post hoc test. The post hoc test is conducted to confirm where the differences occurred between groups. If the p-value of the post hoc test was less than 0.5, there is a significant difference between the two groups.

4.4.1 Comparison of Students' PU between Ages

The significance level of ANOVA was 0.105, representing no significant difference in PU of DLM for different age groups. All the age groups in the post hoc test have a significant level greater than 0.05, indicating that there is no significant difference in mean between age groups. The descriptive statistics also indicate no significant difference between age groups, concluding that there is no significant difference in different ages, considering the degree of improvement in work performance while using DLM. Based on the results, the hypothesis **H3: Age has a positive effect on PU of DLM** is rejected.

4.4.2 Comparison of Students' PEOU between Ages

The significance level of ANOVA was 0.336, representing no significant difference in PEOU of DLM for different age groups. All the age groups in the post hoc test have a significant level greater than 0.05, indicating that there is no significant difference in mean between age groups. The descriptive statistics also indicate no significant difference between age groups, concluding that there is no significant difference in different ages, considering the ease of using DLM. Based on the results, the hypothesis **H4: Age has a positive effect on PEOU of DLM** is rejected.

4.4.3 Comparison of Students' PU between Education Level

The significance level of ANOVA was 0.075, representing no significant difference in PU of DLM for different education levels. All the groups in the post hoc test have a significant level greater than 0.05, indicating that there is no significant difference in mean between groups. The descriptive statistics also indicate no significant difference between education levels, concluding that there is no significant difference between different education levels, considering the degree of improvement in work performance while using DLM. Based on the results, the hypothesis **H5: Education level has a positive effect on PU of DLM** is rejected.

4.4.4 Comparison of Students' PEOU between Education Level

The significance level of ANOVA was 0.966, representing no significant difference in PEOU of DLM for different education levels. All the groups in the post hoc test have a significant level greater than 0.05, indicating that there is no significant difference in mean between groups. The descriptive statistics also indicate no significant difference between education levels, concluding that there is no significant difference between different education levels, considering the ease of using DLM. Based on the results, the hypothesis **H6: Education level has a positive effect on PEOU of DLM** is rejected.

4.4.5 Comparison of Students' PU between Grades of Tertiary Studies

The significance level of ANOVA was 0.008, meaning that there is a significant difference in PU of DLM between grades of tertiary studies. In the post hoc test, Year 1 and Year 4 have a significant level of 0.004, less than 0.05, indicating that there is a significant difference between them. The descriptive statistics show that the means of each grade are 3.5000, 3.9529, 4.0300 and 4.1929, bringing in a conclusion that there is an increase in values when grades increase, considering the degree of improvement in work performance while using DLM. Based on the results, the hypothesis **H7: Higher grades in tertiary education have a positive effect on PU of DLM** is supported.

4.4.6 Comparison of Students' PEOU between Grades of Tertiary Studies

The significance level of ANOVA was 0.043, meaning that there is a significant difference in PEOU of DLM between grades of tertiary studies. In the post hoc test, Year 1 and Year 4 have a significant level of 0.023, less than 0.05, indicating that there is a significant difference between them. The descriptive statistics show that the means of each grade are 3.9143, 4.2706, 4.2500 and 4.4143, bringing in a conclusion that there is an increase in values when grades increase, considering the ease while using DLM. Based on the results, the hypothesis **H8: Higher grades in tertiary education have a positive effect on PEOU of DLM** is supported.

4.5 Pearson Correlation among Motivational Components

Bivariate Pearson correlation analysis measures the strength and direction of the linear relationship between pairs of continuous variables. The values of the Pearson correlation coefficient show that the linear association between two variables lies in the range(r) of -1 to 1, with the sign indicating the direction of the relationship. Positive correlation (+) indicates the second variable increases linearly with the first variable, while negative correlation (-) shows a decreasing correlation. Value is 0 when representing that there is no relationship between, while closer to -1 or 1 represents a stronger correlation. The r values of 0.10, 0.30 and 0.50 demarcate small, medium and large effects, respectively. (Cohen, 1988) If the significance (2-Tailed) value of the Bivariate correlation analysis is smaller than or equal to 0.05, it means that there is a significant difference between two different variables.

4.5.1 Relationship between TF and PU
The Pearson correlation between TF and PU was +0.847, and the significant correlation lies at the 0.01 level (2-tailed). The value presents a strong positive linear relationship between TF and PU. Based on the results, the hypothesis **H9: TF has a positive effect on PU of DLM** is supported.

4.5.2 Relationship between TF and PEOU
The Pearson correlation between TF and PEOU was +0.614, and the significant correlation lies at the 0.01 level (2-tailed). The value presents a strong positive linear relationship between TF and PEOU. Based on the results, the hypothesis **H10: TF has a positive effect on PEOU of DLM** is supported.

4.5.3 Relationship between SF and PU
The Pearson correlation between SF and PU was +0.796, and the significant correlation lies at the 0.01 level (2-tailed). The value presents a strong positive linear relationship between SF and PU. Based on the results, the hypothesis **H11: SF has a positive effect on PU of DLM** is supported.

4.5.4 Relationship between SF and PEOU
The Pearson correlation between SF and PEOU was +0.645, and the significant correlation lies at the 0.01 level (2-tailed). The value presents a strong positive linear relationship between SF and PEOU. Based on the results, the hypothesis **H12: SF has a positive effect on PEOU of DLM** is supported.

4.5.5 Relationship between TeacherF and PU
The Pearson correlation between TeacherF and PU was +0.652, and the significant correlation lies at the 0.01 level (2-tailed). The value presents a strong positive linear relationship between TeacherF and PU. Based on the results, the hypothesis **H13: TeacherF has a positive effect on PU of DLM** is supported.

4.5.6 Relationship between TeacherF and PEOU
The Pearson correlation between TeacherF and PEOU was +0.572, and the significant correlation lies at the 0.01 level (2-tailed). The value presents a strong positive linear relationship between TeacherF and PEOU. Based on the results, the hypothesis **H14: TeacherF has a positive effect on PEOU of DLM** is supported.

4.5.7 Relationship between PEOU and PU
The Pearson correlation between PEOU and PU was +0.745, and the significant correlation lies at the 0.01 level (2-tailed). The value presents a strong positive linear relationship between PEOU and PU. Based on the results, the hypothesis **H15: PEOU has a positive effect on PU of DLM** is supported.

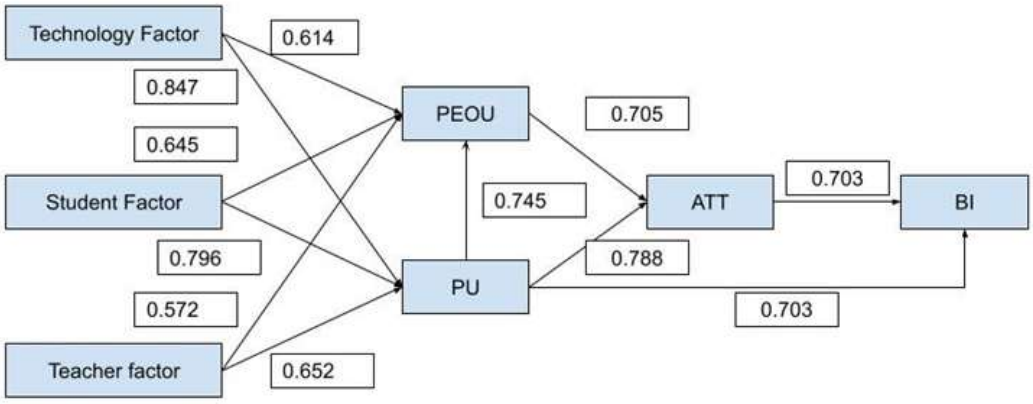
4.5.8 Relationship between PEOU and ATT
The Pearson correlation between PEOU and ATT was +0.705, and the significant correlation lies at the 0.01 level (2-tailed). The value presents a strong positive linear relationship between PEOU and ATT. Based on the results, the hypothesis **H16: PEOU has a positive effect on ATT of DLM** is supported.

4.5.9 Relationship between PU and ATT
The Pearson correlation between PU and ATT was +0.788, and the significant correlation lies at the 0.01 level (2-tailed). The value presents a strong positive linear relationship between PU and ATT. Based on the results, the hypothesis **H17: PU has a positive effect on ATT of DLM** is supported.

4.5.10 Relationship between PU and BI
The Pearson correlation between PU and BI was +0.703, and the significant correlation lies at the 0.01 level (2-tailed). The value presents a strong positive linear relationship between PU and BI. Based on the results, the hypothesis **H18: PU has a positive effect on BI of DLM** is supported.

4.5.11 Relationship between ATT and BI
The Pearson correlation between ATT and BI was +0.703, and the significant correlation lies at the 0.01 level (2-tailed). The value presents a strong positive linear relationship between ATT and BI. Based on the results, the hypothesis **H19: ATT has a positive effect on BI of DLM** is supported.

4.5.12 Results of Relationships among TAM Components



4.6 Discussion

The questionnaire, which aims to investigate Hong Kong students' perception of providing DLM, follows the TAM components and different factors. The data is used to analyse the impact of TAM components, personal characteristics and other factors on students' perceptions of using DLM. The following sections will discuss the overall components of TAM and the interaction between different personal characteristics and TAM factors. Lastly, the discussion will end by discussing the relationship between different factors.

4.6.1 Discussion of Overall TAM Components

Based on section 4.2, the mean value for descriptive statistics of each factor was higher than 3 (NEUTRAL), representing the perspective of students in DLM. The following values represent the mean and standard deviation of the descriptive statistics, followed by an explanation

1. TF – 4.0850 and 0.47329. Students were satisfied with the technology and information quality of DLM.
2. SF – 3.8523 and 0.56504. Students were satisfied with their experience and eager to use DLM. This includes the technology experience, satisfaction, concentration and psychology of respondents. Students perceived that they had significant experience using DLM.
3. TeacherF – 4.0000 and 0.49488. Students were satisfied with the DLM that their teacher used. This includes the attitudes, beliefs, tolerance and training of teachers using DLM.

In TAM, there are also 3 components:

1. PU – 4.0033 and 0.62396. Respondents had a high PU and predicted ATT, both directly and indirectly, towards people's intentions. (Davis, 1989)
2. PEOU – 4.2496 and 0.52299. Respondents believe that using DLM will be free of effort. (Davis, 1989) PEOU will affect ATT.
3. ATT – 4.0510 and 0.53309. Represents the attitude of students using DLM and has a strong relationship with BI.
4. BI – 3.9318 and 0.53619. Respondents have a high intention to use DLM.

The technology and information quality of DLM were high and made students more willing to use DLM. It improves students' learning effectiveness, such as the layout of FLM, which was clear and can enhance user experience, thus affecting PU and PEOU. The attitude and method of teachers using DLM improve PU and PEOU. Lastly, PU and PEOU will affect ATT, while ATT will affect BI.

4.6.2 Discussion of Gender Difference in DLM

The hypothesis **H1: PU of DLM is different between genders** is rejected, thus showing no significant difference in PU between genders. Previous research has pointed out that men and women have different levels of self-confidence and motivations in science and technology. The stereotypical view of different genders using technology was "relative to male users, female users might have more negative attitudes towards technology and technology use." (Canada & Brusca, 1991) The result, however, shows that male and female users had a close thought for PU of DLM. Since there are legal regulations in Hong Kong that ensure education and resources are received equally between men and women, both genders are able to experience the same learning method, which includes technology implementations. This has deeply affected women's attitude towards DLM, especially the younger generations. (Buccheri et. al., 2011)

The hypothesis **H2: PEOU of DLM is different between genders** is rejected, thus showing no significant difference in PEOU between genders. Previous research has pointed out that "female users report less positive

attitudes and self-efficacy towards ICT than male users." (Sølvberg, 2003; Volman et al., 2005; OECD, 2005; Lynch, 2007; Tømte & Hatlevik, 2011) However, the results show that male users and female users had a close thought for PEOU of DLM. This proves that female students are getting more confident in using advanced computer skills, such as computer applications, and are actively catching up with the belief that using a specific system does not require effort. (Naciri, 2016)

4.6.3 Discussion of Age & Education Level Difference in using DLM

The study finds that age and education level do not significantly affect PU or PEOU of DLM. This is supported by One-way ANOVA results, which show no statistically significant differences across age groups or education levels. The lack of significant differences can be attributed to the widespread exposure to technology among Hong Kong's new generation, who have grown up with smartphones and ICT.

1. Age Groups – Respondents from different age groups perceive DLM as helpful in enhancing job performance and easy to use. Thus, the hypotheses **H3: Age has a positive effect on PU of DLM** and **H4: Age has a positive effect on PEOU of DLM** were rejected.
2. Education Levels – Despite differences in the duration of DLM use, students across education levels show high PEOU due to their familiarity with ICT. The hypotheses **H5: Education level has a positive effect on PU of DLM** and **H6: Education level has a positive effect on PEOU of DLM** were rejected.

This supports the finding (Kubiatko, 2013) that where the popularity of electronic technology products increases, as most of the new generation students have been exposed to electronic technology since their childhood. They considered that the majority of internet-related items are commonplace and do not have problems with their use. This also rejects the findings of Alenezi (2023), where the author describes that students from higher education are affected the most in digital transformation.

4.6.4 Discussion of Grade Differences in Tertiary Studies

Grade level within tertiary studies shows a statistically significant difference in both PU and PEOU of DLM, as per One-way ANOVA results. Higher-grade students report higher PU, indicating they believe DLM enhances their work performance more than lower-grade students. This is likely due to greater exposure and experience with DLM in university settings. Higher-grade students also report higher PEOU, finding DLM easier to use. This is attributed to their advanced ICT literacy, including skills in information management, analysis, and evaluation. As universities in Hong Kong extensively use DLM, students in higher grades have more experience, enabling them to relate new information to prior knowledge (Lustbader, 1998). This supports the hypotheses **H7: Higher grade in tertiary education has a positive effect on PU of DLM** and **H8: Higher grade in tertiary education has a positive effect on PEOU of DLM**.

4.6.5 Discussion of TF

TF, which encompasses technology and information quality, positively affect PU and PEOU. High-quality DLM systems with simple interfaces and clear layouts enhance ease of use and usefulness, supporting prior studies. (Fathema & Sutton, 2013; Park et al., 2012) Thus, it supports the hypotheses **H9: TF has a positive effect on PU of DLM** and **H10: TF has a positive effect on PEOU of DLM**. This is similar to students agreeing that media-related abilities help them utilise digital technologies, which will improve their digital learning. (Sayaf et. al., 2022)

4.6.6 Discussion of SF

SF, including technology experience, satisfaction, concentration, and psychological pressure, positively correlate with PU and PEOU. Students with higher SF perceive DLM as more useful and easier to use, supporting the hypotheses **H11: SF has a positive effect on PU of DLM** and **H12: SF has a positive effect on PEOU of DLM.** (Baki et al., 2018)

4.6.7 Discussion of TeacherF

TeacherF, including satisfaction with teaching methods and teacher attitude, positively influence PU and PEOU. Effective teacher-student interactions via DLM reduce distractions and improve learning effectiveness. Therefore, it supports the hypotheses **H13: TeacherF has a positive effect on PU of DLM** and **H14: TeacherF has a positive effect on PEOU of DLM**. This supports the idea that teachers may require continuous professional development and training in digital learning materials. (Camilleri & Camilleri, 2016)

4.6.8 Discussion Between PEOU and PU

PEOU positively affects PU, as easier-to-use systems are perceived as more useful, aligning with Expectation Confirmation Theory. (Oliver, 1980) Thus, hypothesis **H15: PEOU has a positive effect on PU of DLM** is

supported. This also supports the study by Cho and Hung (2009), which shows the relationship between PEOU and PU in e-learning.

4.6.9 Discussion of PEOU and PU on ATT

Both PEOU and PU positively influence students' attitudes toward DLM. Higher PEOU reduces effort, and higher PU improves performance, leading to favorable attitudes. (Šumak et al., 2011; Alfadda & Mahdi, 2021) Thus, hypotheses **H16: PEOU has a positive effect on ATT of DLM** and **H17: PU has a positive effect on ATT of DLM** were supported.

4.6.10 Discussion of PU and ATT on BI

PU and ATT positively affect BI. Students are more likely to use DLM if they perceive it as applicable and have a positive attitude, consistent with TAM (Davis, 1989; Ajzen & Fishbein, 1980). Thus, hypotheses **H18: PU has a positive effect on BI of DLM** and **H19: ATT has a positive effect on BI of DLM** were supported.

5. Conclusion & Suggestions

The study results are shown in the following table:

Hypotheses	**Result**
H1: PU of DLM is different between genders	*Rejected*
H2: PEOU of DLM is different between genders	*Rejected*
H3: Age has a positive effect on PU of DLM	*Rejected*
H4: Age has a positive effect on PEOU of DLM	*Rejected*
H5: Education level has a positive effect on PU of DLM	*Rejected*
H6: Education level has a positive effect on PEOU of DLM	*Rejected*
H7: Higher grade in tertiary education has a positive effect on PU of DLM	*Supported*
H8: Higher grade in tertiary education has a positive effect on PEOU of DLM	*Supported*
H9: TF has a positive effect on PU of DLM	*Supported*
H10: TF has a positive effect on PEOU of DLM	*Supported*
H11: SF has a positive effect on PU of DLM	*Supported*
H12: SF has a positive effect on PEOU of DLM	*Supported*
H13: TeacherF has a positive effect on PU of DLM	*Supported*
H14: TeacherF has a positive effect on PEOU of DLM	*Supported*
H15: PEOU has a positive effect on PU of DLM	*Supported*
H16: PEOU has a positive effect on ATT of DLM	*Supported*
H17: PU has a positive effect on ATT of DLM	*Supported*
H18: PU has a positive effect on BI of DLM	*Supported*
H19: ATT has a positive effect on BI of DLM	*Supported*

Table 5.0 Results of the Hypotheses

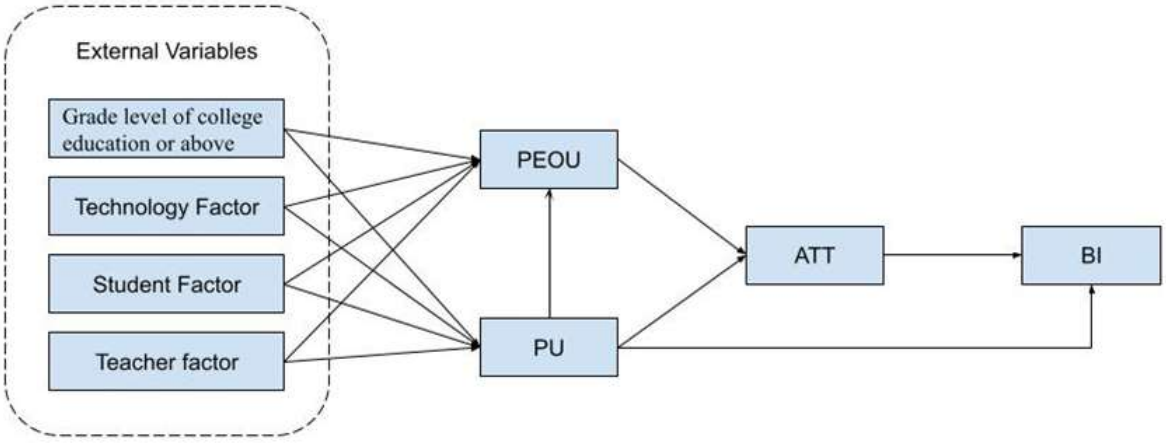


Fig 5.0: General Extended Technology Acceptance Model of Hong Kong Students' Perception in DLM

The results show that Hong Kong students believe that DLM is easy to use and serves as an effective role in the education system. This implies that Hong Kong students prefer DLM to be included in their syllabus after the materials are assessed with the external variables above. Students also believe that if the education system is valuable and easy to cope with, they will be more likely to study and revise. Thus, DLM can be a useful milestone to boost students' urge of learning.

5.1 Suggestion

After collecting data, it was found that TF, SF and TeacherF were the main external variables influencing the student acceptance and intention to use DLM. Thus, the following are suggestions based on the factors:

1. TF represents the technology and information quality of DLM. Improving the system interface to make it easier to understand, helping students to record key points and make notes, improves their PEOU and PU.
2. SF represents the technology experience, satisfaction, concentration and psychological pressure of respondents. Schools can set a transition period for students to adapt to DLM and accumulate experience in using DLM, increasing their satisfaction.
3. TeacherF represents the students' satisfaction with the teachers' method with DLM and teacher attitude. Teachers and institutions can set up a scoring and feedback system, allowing students to reflect on their ideas of DLM. Teachers can then improve their DLM methods by responding to or solving students' difficulties in using DLM.

5.2 Limitations of the Study

There were 2 main limitations of this study:

1. Time limitation – As the research is conducted during the COVID-19 pandemic, most schools have already implemented online teaching, making it challenging to collect data. Thus, only 121 responses were collected. More data will be needed to improve accuracy.
2. Small and uneven distribution of data samples – Small data collection affects the study's representativeness. In addition, the groups are not evenly represented in terms of gender and age. There were also no representatives beyond the age of 27.

5.3 Future Research

After the study, 2 recommendations were suggested for future research:

1. The study focuses on students from secondary school to the tertiary level. However, it was believed to have a greater impact in primary school and early education as it requires more activities and interaction. Future research is advised to focus on this direction. As they lack the ability to complete the questionnaires, it is advisable to collect data through interviews and researcher test assistance, thus requiring more research time.
2. Future research is advised to investigate the influence of subjects towards DLM. The LM for science and liberal arts may be different, as science involves numerical formulations while liberal arts involves vocabulary. Thus, significant differences may be observed in future studies.

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