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Interface Designs with Personality Types: An Effective E-learning Experience

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Abstract: E-learning has always been a part of higher education learning for several years now. This paper investigates the different personality types of students and their personality preferences. A survey questionnaire was distributed among students of higher learning to investigate and to see the different user interface designs of their liking. The results of the survey were analyzed in detail to find out students' preferences. This research project has reached its goal of finding and investigating the relationship between human personality types, specifically on the MBTI personality type and user interface designs in electronic learning.

Keywords: e-learning; MBTI; user interface; human personality types

1. Introduction

In the present day, educational institutions have adopted the use of technology. These range from kindergartens, primary schools, secondary schools to tertiary education institutions such as colleges and universities. In 2018, technology can be seen as a tool that has been ingrained into the minds of everyday humans. For example, the usage of smartphones and smart computers (such as in cars) are pervasive throughout all modern societies across the world. In institutions of higher education, the issue of utilizing modern information and communication technologies for teaching and learning is very important[1)]. E-learning systems are emerging in many settings of our society[2)]. It plays a significant and increasing role in education and training, whereby making learning available nearly anytime and anywhere[3)]. The incorporation of technology in the classroom has been used not only in developed countries but also in less developed countries. It is now a growing trend to include technology in the classroom environment in order to fulfil the technological expectations of students[4)].

Several tools are used in the field of e-learning. These tools are essential and necessary for the expansion of knowledge during the process of learning. The tools used are RSS and Podcasting[5), 6)]. These tools contribute greatly to e-learning.

RSS stands for Really Simple Syndication. As simple as the name suggests, what the RSS does is simple. It allows users to access updates on any online content from a particular in a format that is more organised and standardised. For example, in a web article, RSS is capable of keeping posted on the latest information online[6)]. This information can be related to anything under the sun, for instance, news and weather updates.

One of the most popular digital media players, the Apple iPod has many variations. They include the original iPod, iPod nano and the iPod touch. The iPod provides many functions like listening to music, and broadcast videos (on the iPod touch, also known as iTouch in short). The combination of the iPod and broadcast have made "podcasting" available and exists till today[5)]. These podcasts are audios that are made available for download to listeners via RSS.

2. Literature Review

In this present day with the advanced technology that we are living in, the use of mobile devices and mobile applications is no longer an unusual scene. The selling of smartphones has been immensely popular and has taken over the market throughout the years. Currently, mobile application developers have been very successful with the increasing number of users of mobile applications[7)]. This field of technology has been advancing, expanding and improving throughout the years, and it is believed to be better in the future. Its advancement of mobile technologies has now opened to new chances for teaching and learning for teachers and students.

Software companies are now emerging very fast because of the big number of downloads done by users. The rapid growth and the increasing trend on the usage of mobile application on a mobile device and the widespread availability of hand-held devices like tablets, phablets and smartphones, are due to a number of reasons[8)]. This can be further explained in several viewpoints. From a

software programmer's point of view, developing mobile applications is considered simple as it is similar to developing applications on a desktop computer. In the aspect of software development, the advantage and the ability of code reuse greatly contribute to ease the software development process with the usage of classes, specifically in object-oriented programming[9]. Programming languages play a major role in the development and languages such as Java (on an Android platform) and Swift (on an Apple iOS platform) to support code reuse.

Classrooms have now included mobile devices such as tablets and smartphones as part of their teaching practice[10]. The benefits of mobile technologies, especially in relation to mobility, have greatly contributed to the improvement of education. Today, many users carry their mobile phones or other mobile devices wherever they go; and the added convenience, mobility and widespread availability of mobile devices have already become a hallmark of every modern society.

One of the key reasons why mobile applications are gradually taking over desktop and web applications is because of their user interface design. Due to the size of the screen of a mobile device, the user interface designs in a mobile application are more compact and concise. Therefore, we observe a trend today whereby many software developers and companies are moving towards building more mobile applications and moving their traditional user engagement channels towards mobile applications. Such companies and institutions include even governments, financial institutions, international banks, and institutes of lower and higher education. As a matter of fact, there are many ways and practices in a mobile application that can ease the work of the developer[25]. For instance, the adoption of practices can be acquired by developers and designers using other templates that have sets of user interface elements that are used by others[11] .

Dating back to the early years in the 1980s, human-computer interaction, also known as HCI, developed as a discipline and a community in the field of information technology[12]. It was heavily influenced and triggered by the revolution of personal computers (PC) and the birth of graphical user interfaces. A simple definition of HCI is the research of how different users interact with different computer systems[13]. Human-computer interaction consists of three main components that include the user, the computer and the interaction. In layman terms, it is the study of the interaction between the user and the computer. Its main goals are to achieve good functionality and usability. This, in turn, will increase the effectiveness of user interaction with a computer system and creates a better user experience[14].

Developing a graphical user interface is a generally complicated task[15), 24]. Much research must be done by the designer before proceeding to development, such as the behaviour of the target users. For example, the design for the elderly is normally focused on simplicity and the design for the young is normally more advanced and sophisticated. This task does not only require good programming knowledge, but it is also very time-consuming. In the current IT trend, such as the Internet of Things, most systems are built by non-expert users and they are evolved quickly to adapt to new situations and requirements. Thus, the need for a cost-effective and intuitive approach for creating graphical user interface is especially emphasized[15]. This goes to show the importance of a graphical user interface design in system development still holds much importance in the present.

User interface design choices stand a lot on end-users' needs elicitation[16]. According to Guntupalli[17] , a good user interface design must match the skills of users and it involves human factors. He mentioned that human factors in interface design play a huge role and should be considered when designing the user interface. In real life, humans tend to be more inclined to interact with personalities that relate to themselves[27]. For example, a quiet person would be closer to another quiet person rather than a more outgoing person. Current research also indicates that users choose to reach out to user interface designs that reveal signs in accordance with their own personalities[18]. In other words, users are more receptive to different user interface designs that are designed with reference to their respective personality types.

One of the classic methods in evaluating a person's personality type is the Myers-Briggs Type Indicator (MBTI). The MBTI is a theoretical perspective that classifies users into 16 different personality types based on an assessment of the various characteristics of the user's personality administered through a survey. The MBTI started with Carl Jung, a pioneer in the field of analytical psychology, who suggested that people can be categorised into various personality types[19]. The main concept behind the categorisation is based on how people relate to the world around them. It is also stated that each person is inclined to a particular preference depending on his or her personality type that works in every functional area.

Based on the journal article by Lindsey[19], Jung also said that the human mind has four functions that are divided into two opposing functions, that are Thinking or Feeling, and Sensation and Intuition. Since there are opposing functions, which means that Thinking is opposed to Feeling whereas Sensation is opposed to Intuition. Furthermore, people can be divided into two types, where one group prefers an internal world known as Introversion and the other prefers an external world known as Extraversion. In layman terms, Introversion also means an introvert and Extraversion also means an extrovert.

Isabel Myers and her mother, Katharine Cook Briggs are the famous developers of the MBTI. The MBTI was built upon the theories of Jung. The MBTI is a tool that measures a person's preferences in a spectrum of four

different dimensions. This tool is widely used by many psychologists in counselling for planning and developing careers[20].

The Myers-Briggs Type Indicator consists of groups that were derived by the theories of Jung, such as the opposition between Thinking and Feeling, Sensing and Intuition and the preferences of extraversion and introversion amongst people. The changes made by both Isabel Briggs and Katherine Briggs were adding a new dimension into MBTI, known as the Judgement and Perception dimension. The Judgement and Perception dimension defines as the orientation and attitudes to the outside world.

The overall model of the MBTI is shown in Table 1. The table shows all the personality types and their dominant function for each personality. The number of personality types is sixteen in total[21].

Table 1. Myers-Briggs Type Indicator (MBTI) model

Type	Dom.	Type	Dom.
ISTJ	S	ISFJ	S
ISTP	T	ISFP	F
ESTP	S	ESFP	S
ESTJ	T	ESFJ	F
INFJ	N	INTJ	N
INFP	F	INTP	T
ENFP	N	ENTP	N
ENFJ	F	ENTJ	T

Note: Type indicates the personality type.
Dom. indicates the dominant dimension.
I refer to Introvert and **E** refers to Extrovert
S refers to Sensing and **N** refers to Intuitive
F refers to Feeling and **T** refers to Thinking
J refers to Judging and **P** refers to Perception

Therefore, this paper aims to propose an e-learning mobile application that is customised to have different user interfaces for students according to their personality preferences. The personality preferences will be evaluated and measured using the MBTI test instrument. This research hopes to find out and discover the suitable user interface for the many different personalities of students in an institution of higher learning in Malaysia.

3. Problem Statement

In this present world, technology simply is still growing from now. Rapid technological advancement is happening so quickly, especially with the presence of the Internet, many government organisations and educational institutions have a centralized system to manage their resources. Specifically, in the field of education, universities and colleges have a proper learning management system also known as LMS. The learning management system in these institutions allows the exchanging of learning materials easier, for example, lecturers can upload their teaching materials online that include the course's teaching plan and lecture notes for students. On the other hand, students can view the materials provided by the lecturers for their own studying/use. Students can use this system as a platform to do their learning, that functions somehow as an e-learning application. However, even with the existing learning management system that universities use together with the advantages that they provide, several issues are faced by students. This study will investigate more detail, specifically in the graphical user interface or the visual representation of the system to students.

The problem of the existing system is that many students find it difficult to communicate with the system. According to Cardinali[22], user interface designs in a computer system plays a very important role to allow a system to effectively function. In the context of using a learning management system, users by default will not pay much attention to the user interface as it is not as prominent and obvious as the functions of the system, like downloading course materials. However, in actual fact, the interface of the system acts as the bridge between the user and the system. Therefore, the relationship between them is crucial as it unleashes the strength of the software program. This fosters a good relationship and creating a suitable user interface can indeed help the user to communicate well with the system to utilize its functions[23].

Another problem that is being faced is that there is no existing system that recognises personality-based user interfaces, especially in the field of education. Based on the journal article by Karsvall (2002), personality factors actually do influence the users' interface design preferences. For example, extroverts prefer designs that are distinct and annoying whereas introverts prefer designs that are comfortable and insecure[18]. This brings us back to our context, where students from any institution come from many backgrounds, that range from many different personalities. Thus, in this research, the Myers-Briggs Type Indicator is used as a measuring tool or a matrix to determine a person's personality type and to investigate which user interface designs are more appealing and suitable for them. This will ensure that the user interface meets the requirements of the users that will be utilizing the system.

Another problem that is faced by users is that users are dissatisfied with the system because of a poorly designed interface[28]. This can lead to a reduction in work productivity in terms of user experience[22]. For example, a user who is not satisfied with the system may be demotivated to produce work that is required of him, which in turn will impact many other factors. Coming back to our context, students that lack of motivation in studying will negatively affect their studies. Therefore, it is important for a system to not only be functional but to also influence the user to use the system at ease. Thus, an effective graphical user interface plays a very important role in developing and designing a system.

4. The Material and Method

The technique of quantitative research is used to gather information through the creation of surveys via an online platform[26]. The survey was distributed to online users.

The main focus of this research is centred upon to find out the relationship between user interface designs and personality types based on the Myers-Briggs Type Indicator for students. Therefore, the survey that was created was distributed among students in a few higher institutions of learning in Malaysia. The purpose of the survey was to find out the different personality types that students possess and the user interfaces elements that they prefer, as they were given a few options to choose from. Some of the user interface design elements that were asked in the survey were font styles, background colours, foreground colours and user interface layouts. The tool was used to collect more user requirements and suggestions that can help improve the e-learning application.

The online survey questionnaire applied different approaches. Questions that were included in the survey were mostly multiple-choice questions. These multiple-choice questions are made up of radio-buttons as answers for users to choose. These answers either come together with text or pictures for better visualization. The last option of every multiple-choice question included the "Other…" option that gives the user a choice to write in their own desired choice of an answer for that question. Besides that, the very last and one and the only question was illustrated in the form of a check-box. It functions exactly like a multiple-choice question but allows the user to give more than 1 answer out of all the options. Same as the radio-buttons, it has another "Other…" option that gives the user another choice to write in their own desired choice of answer.

The survey consists of three major sections and one minor section. Before respondents are redirected to the major sections, respondents need to first go through a minor section. The minor section is to ensure that all respondents have done the Myers-Briggs Type Indicator personality test before proceeding to the major sections.

Section 1 is the verification stage where it functions to collect a little bit of the respondent's information such as the respondent's personality type, age and gender. Section 2 is the Fonts section where it collects the respondent's preference towards different font types, font sizes, font colours and font styles. Section 3 is the Background, Foreground Colours and User Interface Layout section where it collects the respondent's preference towards different background colours, foreground colours, different mobile screen layouts. The last part of this section also included an opinionated checkbox-like multiple-choice question to get the requirements from the respondents as to what feature they hope to look out for in the future in an e-learning application.

5. Results and Discussion

Based on the survey results conducted, there was a total number of 468 respondents that performed this survey. All results from each and every section of the survey were examined and studied before doing the following analysis.

This minor section of the survey is crucial to study the respondent's knowledge of their own personality type. According to the results, only 25 respondents out of the total 468 respondents have actually done the personality test before or have already known their personality type beforehand before even performing the survey. The remaining 443 respondents have never done the personality test before, therefore, they are not even aware of their own personality type.

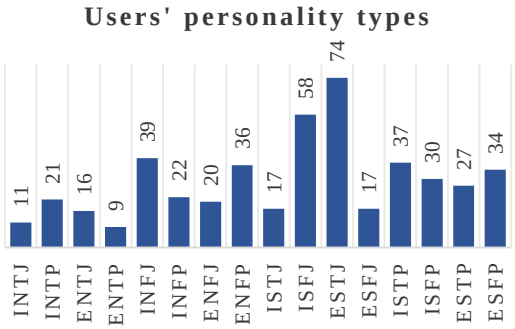

Fig. 1: Number of users' personality types

Based on Figure 1, it can be seen that out of the total 468 respondents, most of the respondents come from the ESTJ personality type group, and that is, 74 respondents in total with a percentage of 15.81% out of the total percentage. The second highest personality type group is ISFJ with 58 respondents in total with a percentage of 12.4% out of the total percentage. The third highest group comes from INFJ with 39 respondents in total with a percentage of 8.3% of the total percentage.

Table 2 presents a more detailed analysis of the above data finding based on the bar chart in terms of percentage.

Table 2. Number of respondents and their personality types

Personality Type	**Number of students (respondents) in %**
INTJ	2.35%
INTP	4.49%
ENTJ	3.42%
ENTP	19.23%
INFJ	8.33%
INFP	4.7%
ENFJ	4.27%
ENFP	7.69%
ISTJ	3.63%
ISFJ	12.39%
ESTJ	15.81%
ESFJ	3.63%
ISTP	7.9%
ISFP	6.41%
ESTP	5.77%
ESFP	7.26%

Results show that most of the respondents come from the "18 to 25 years old" age group, with 310 respondents out of 468 respondents coming from this group. This is largely due to the survey being distributed amongst college and university students enrolled in higher educational institutes. A total of 129 respondents out of 468 respondents were from the "26 to 30 years old" age group, most likely to be final year university students. The other 2 respondents belonged to the "above 30 years old" age group.

The last criterion is gender where it is made up of male, female and option for respondents who prefer not to say. Most of the respondents were males that made up of 226 respondents and the others were all female that made up of 242 respondents. All respondents were comfortable in revealing their genders.

The next major section is the Fonts section. This section gathers the preference of different font styles of respondents such as font size, font colour and font style. The results are shown in Tables 3, 4, 5 and 6.

.

Table 3. Users' Preference to Font Types and Font Sizes

Fonts	**Font Types**	**Font Sizes**				
	Preference	**12pt**	**14pt**	**16pt**	**18pt**	**20pt**
Lato	53	6	12	22	10	3
Open Sans	116	0	3	79	19	7
Old Standard TT	57	7	20	18	8	2
PT Serif	32	0	17	11	4	0
Ubuntu	44	7	12	23	1	1
Droid	171	5	43	41	64	11
Others	1	1	0	0	0	0

Table 4. Users' Preference to Font Colours

Fonts	**Font Colours**				
	White	**Black**	**Yellow**	**Green**	**Blue**
Lato	11	27	10	2	3
Open Sans	3	17	15	11	64
Old Standard TT	3	9	31	8	6
PT Serif	12	6	4	3	7
Ubuntu	21	8	2	2	11
Droid	41	102	12	9	7
Others	0	1	0	0	0

Table 5. Users' Preference to Font Sizes

Fonts	**Font Size**		
	Bold	**Italic**	**Underlined**
Lato	27	25	1
Open Sans	71	37	2
Old Standard TT	42	15	0
PT Serif	25	7	0
Ubuntu	19	22	3
Droid	90	79	2
Others	1	0	0

Table 6. Users' Preference

Colours	**Background**	**Foreground**
White	51	195
Black	197	106
Blue	66	72
Red	87	26
Yellow	67	65
Others	51	4

A list of 5 different user interface layouts was given as examples in the survey for respondents to choose as shown in Figures 2, 3, 4, 5 and 6. The result is shown in Table 7.

Fig. 2: Layout 1

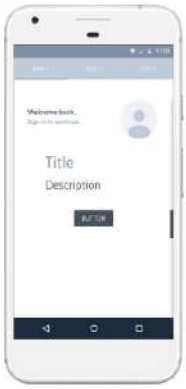

Fig. 3: Layout 2

Fig. 4: Layout 3

Fig. 5: Layout 4

Fig. 6: Layout 5

Table 7. Users' Preference to User Interface Layouts

Layouts	**Number of respondents**
Layout 1	83
Layout 2	111
Layout 3	33
Layout 4	176
Layout 5	65

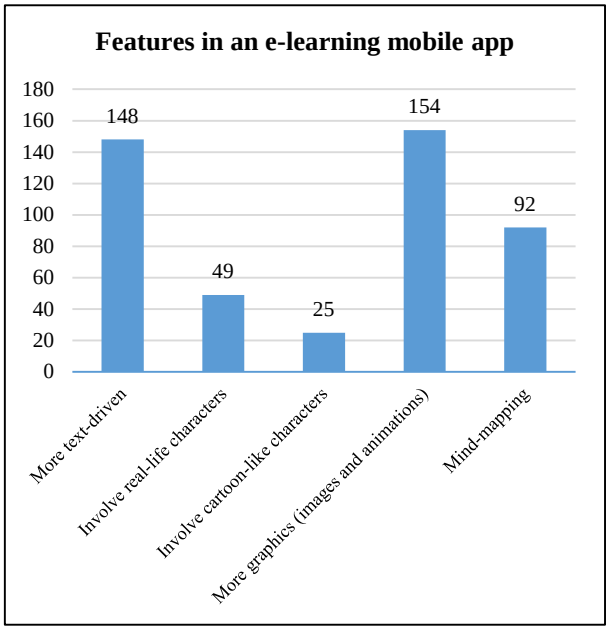

Fig. 7: E-learning mobile app features

This is the last and final part of the survey to look at the proposed features of every respondent that can be improved in the development of an e-learning mobile application. The bar chart in Figure 7 shows the analysis of the results based on the list of proposed features for the improvement and development of an e-learning mobile application.

Based on the overall results and findings from the survey, the highest number of respondents are from the ESTJ, ISFJ and INFJ personality type. Therefore, these 3 personality types will be chosen for the development of user interfaces in the mobile application. Each user interface design will be designed based on their preferences provided for font types, font sizes, font colours, background colours, foreground colours and user interface layouts.

A. Functional Requirements

The functional requirements that can be seen and delivered in these projects are as below:

1. Selection of different user interface designs
2. User administration and management
3. Performing the MBTI personality test
4. Presentation of learning course materials
5. Access outside of classroom learning

B. Use Case Diagram

Figure 8 represents the use case diagram of the system. The actors in the system are the student and the system itself. This diagram shows the relationship between them, and what activities they perform.

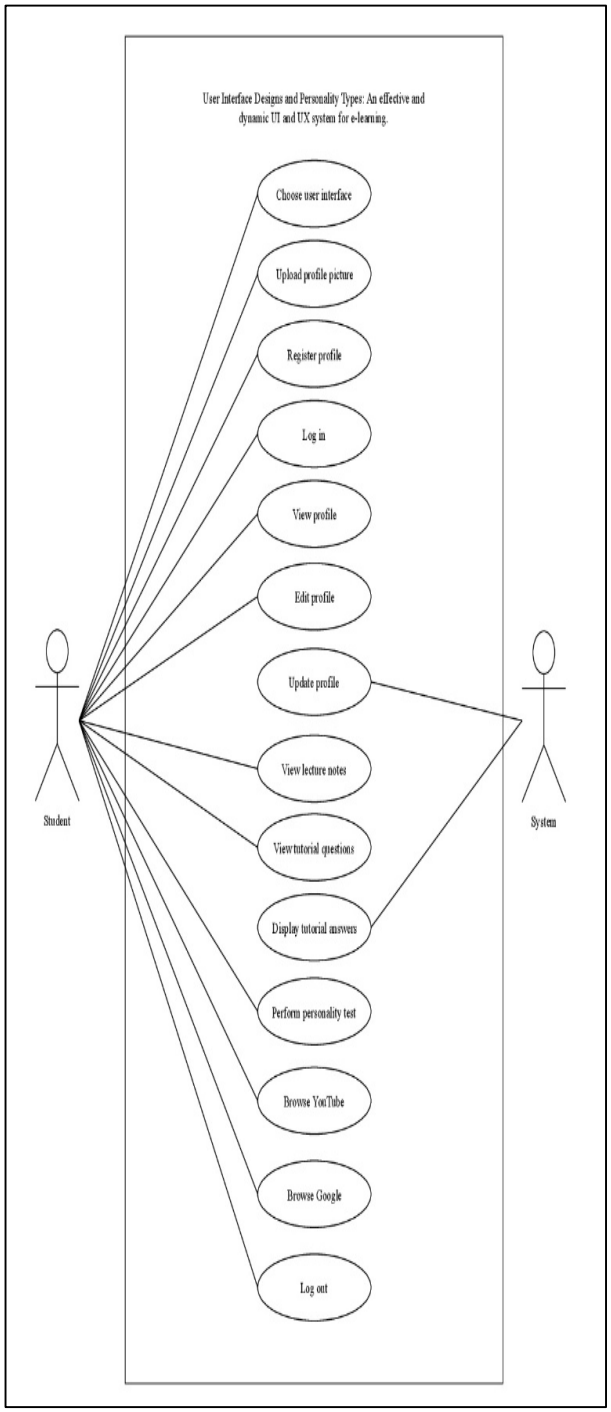

Fig. 8: Use Case Diagram

C. User Interface Designs

Figures 9, 10 and 11 show the user interfaces for the presentation of course materials such as lecture notes and tutorial exercises in the ESTJ, ISFJ and INFJ interface. Users can swipe across the screen to switch to the next page or select the page on the tabs above. Tutorial answers are hidden by default and users can unhide them by clicking on the question.

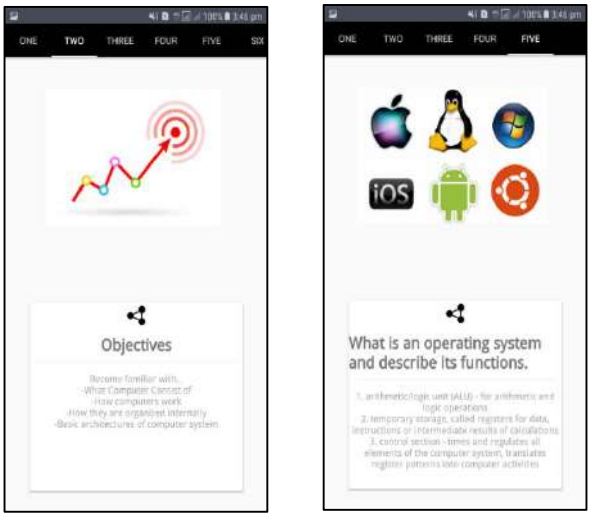

Fig. 9: ESTJ user interface

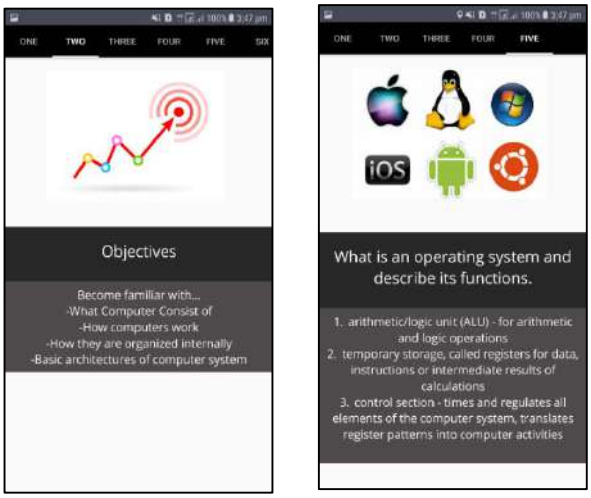

Fig. 10: ISFJ user interface

Fig. 11: INFJ user interface

D. Evaluation

Evaluation and testing were carried right after the development of the system. An interview was conducted to understand and collect the feedback of the users when using the system. The results of their feedback are shown and explained below.

The interviews are conducted among 5 users with different personality types and are based on 2 phases. Phase One is about how users perceive the system features and Phase Two is about users' own opinions and suggestions for the system. The names and identities of the users are not revealed due to confidentiality of users and all of them preferred for their names to be kept anonymous. Therefore, they will be named by Person A, Person B, Person C, Person D and Person E.

E. Phase One Results

The following is the list of features that can be found in the system and the users' response. All five users were able to perform the 23 features listed.

Users were able to:

- execute and run the application at the start.
- select different user interfaces based on their personality type.
- upload their own profile picture from the mobile device.
- register an account in the system.
- see an error message if any of the registration fields are empty.
- log in to the system.
- see an error message if he or she inputs an invalid email or password.
- redirect to the correct user interface based on their selection.
- see their name listed on the home page.
- access the MBTI Personality Test after pressing the "Find Out More" button in the default user interface.
- access the "Profile" button on the home page.
- edit information in the "Profile" page.
- update information in the "Profile" page.
- access the "Lecture" button on the home page.
- access the "Tutorial" button on the home page.
- access the "YouTube" button on the home page.
- access the "Google" button on the home page.
- swipe to the next page and back on the "Lecture" page.
- select the tabs/pages on the "Lecture" page.
- swipe to the next page and back on the "Tutorial" page.
- select the tabs/pages on the "Tutorial" page.
- unhide the answers on the "Tutorial" page.
- log out from the system.

F. Phase Two Results

Person A: Person A is a final year undergraduate student from UCSI University that possesses an ISFJ personality type. According to Person A, he was quite satisfied with the overall experience of using the mobile application. This was because he felt that the design of the user interface fits his personality type. He mentioned that the mobile application is easy to use. However, he suggested that the flow of the system should be improved as he was quite confused at first when he wanted to login because the flow of the system was designed in such a way that the registration page comes first before the login page. Besides that, Person A expressed his concern on the internet connection. As this mobile application runs on an online database, he said that the application might not be useful as he will lose access to his course materials if he is not able to get any internet connection. He also suggested a download feature to allow users to download their course materials when they are online so that they are able to access their course materials in whatever situation. His final rating of the application of a scale of 1 to 10 was a 7, which is quite satisfactory.

Person B: Person B is a second-year undergraduate student from UCSI University that possesses an ENFP personality type. Due to his extroverted nature, he was very satisfied with the user interface design as he found it very interactive and that it appeals to him a lot. He mentioned that the colour combination around the user interface objects on the screen complement each other a lot and that the user interface was very responsive to his finger touches on the screen. However, he mentioned that although he was satisfied with the user interface design, he felt that the application was lacking more exciting features. He said that the features were quite dull and common, and suggested that it could be made better if video tutorials can be implemented in tutorial exercises. He said that while designs can be interactive and attract the attention of the user, but ultimately the user has to reach his final objective to understand that particular topic. His final rating of the application of a scale of 1 to 10 was an 8.5, which is good.

Person C: Person C is a pre-university student at UCSI University who will be pursuing her degree soon. She possesses an ISTJ personality type. According to Person C, she was quite confused with the user interface design after doing the personality test. Because the prototype of the system only contains 3 customized user interfaces that did not contain her personality type, she felt that the other introverted designs did not reach her expectations. However, she complimented the extra learning source features that are in the application especially the YouTube function. Person C said that she does a lot of video learning via YouTube, so it is very much useful for her to access YouTube directly from the e-learning application itself. This is because multitasking between applications on her phone can cause her phone to be sluggish, thus causing her whole user experience to fall. Her final rating of the application of a scale of 1 to 10 was a 7, which is quite satisfactory.

Person D: Person D is also another a second-year undergraduate student from UCSI University that possesses an INFJ personality type. Because the prototype system contains his personality type, he was very happy with the design that was made as it suits him very well. In contrast to this, he commented that while he is satisfied with the design, he said that this design should not be generalized for all INFJs. Furthermore, he suggested that the need to interact with teachers or lecturers is still needed for a particular subject or course. This is so that they can ask immediate questions should they meet any problem regarding the subject or course. A chat function is proposed by him that can function like instant messaging, so communication can be made easier and faster between the teacher or lecturer and the student. His final rating of the application of a scale of 1 to 10 was a 9, which is close to excellent.

Person E: Person E is a soon-to-be graduating student at UCSI University that has an ESTJ personality type. His comments on the user interface design were also good, as he felt the colourful user interface was able to capture his attention a lot and it attracts him. He did not make too many comments on the design as he was more concerned about the features in the system. Person E suggested that the tutorial exercises can be improved better by implementing quizzes or online test that can immediately test the student if the students understand a topic or not. Because of his great experience in studying, he felt that tackling exam questions is a priority and that implementing small tests like these can help increase the academic performance of students while at the same time having fun with the system design. His final rating of the application of a scale of 1 to 10 was a 7.5, which is close to good.

6. Conclusion

The development, testing and deployment of the e-learning mobile application has achieved its aims and objectives. The final product is a semi-finished e-learning mobile application that runs on an Android mobile platform, which allows users to be aware of their MBTI personality type, and deploys different user interfaces based on the personality type of the end-user, which are specifically designed for these personality types with the aim of increasing their productivity and ease of learning. The main way which this works is through understanding how each personality type perceives and absorbs learning information, and to understand collectively the design elements which work best for different personality types through a survey amongst students of higher education across various institutions of higher learning. The project took inspiration from various other practices and studies which also use the MBTI personality type to solve other real-life problems. Towards the end of the project, final feedback was sought from the test users to evaluate if the

objectives were met and to find other areas of improvement to take the project further forward.

This project has contributed a lot to the field of human psychology on human personality types and human-computer interaction in general. This research project ultimately has also reached its goal of finding and investigating the relationship between human personality types, specifically on the MBTI personality type and user interface designs in electronic learning. In the future, universities and colleges can utilize this research further to cater more designs for other personality types and follow the practice of using personality types as a measure to improve learning productivity and increase learning interest amongst students in higher education. As a result, this can transform e-learning to a different approach and dimension and learning, in general, will be very different from the present.

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