CHAPTER 2

LITERATURE REVIEW

2.1 Usability definition

According to Jeng (2006), usability is constructed from many perspective, such as efficiency, effectiveness, subjectively pleasing, memorability and other. Meanwhile Nielsen (1993) point out that there are 5 aspect of usability, such as learnability, efficiency, memorability, error recovery, and satisfaction. Blandford and Buchanan (2002a) suggest that usability is technical, cognitive, social, and design oriented and it is important to bring these different perspectives together, to share views, experiences and insights.

Thomas (1998) categorize usability consist of 3 aspect, result, process and task. Result comes from efficiency, effectiveness and satisfaction. Process comes from ease of learning, efficiency to use, subjectively pleasing, ease of remembering and error recovery. Task comes from compatibility and functionality. While Gould (1988) divide usability into system performance (reliability, responsiveness), system functions, user interface, reading materials, language translation, outreach program, ability for customers to modify and extend, installation, field maintenance and service-ability, advertising, and support group user. Landauer (1995) defines usability means ease of operation and created for a purpose. Then, Brinck, Gergle, and Wood (2002) share usability as functionally correct, efficient to use, ease of learning, memorability, low rate of error, and satisfaction.

Booth (1989) outlines four factor of usability: ease of use, ease of learning, likeability and usefulness. Thomas (1998) stated, satisfaction is the most important aspect in usability and usefulness is being overlooked. Blandford and Buchanan (2003) defines usability as 1) how efficient and effective user able to achieve target on using software or products, 2) how ease user learn to use software or products, 3) how software or products able to help user avoid error and if it happens, it will provide solution, 4) how user find it is pleasant to use software or products and 5) how software or products fit with the context. Dumas and Redish (1993, 4) define usability happen when user able to learn and use software or products easily and reach their goal. While

Guillemette (1995, 215) refers usability to “How information system able to be used by user to complete the task”.

Clairmont, Dickstein, and Mills (1999) also state user able to learn and use software or products and successfully reach their goal. Karoulis and Pombortsis (2003) suspect that usability (effectiveness, efficiency, and satisfaction) and learnability of educational environment are positively correlated and wonder how far one affects the other. Shackel (1991) define usability consist of four aspects: user, task, tool, and environment. There are 2 categories of usability: inherent usability and apparent usability (Kurosu and Kashimura 1995). The International Standard Organization (1994) defines usability as software or product is used to achieve goal with effectiveness, efficiency and satisfaction. Hix and Hartson (1993) classify usability into initial and long term performance, ease of learning, retainability, advanced feature usage, first impression, and satisfaction. Meanwhile, Karoulis and Pombortsis (2003) suspect that usability (effectiveness, efficiency, and satisfaction) and learnability of educational environment are positively correlated.

Usability means how software or products can be used easily and effectively by people (Shackel, 1991). Usability constructed by interaction between tools, problems and people (Naur, 1965). Usability is the challenge to established usability techniques and measures from new contexts of use such as home technology (Monk, 2002). ISO/IEC 9126 defines usability as a set of attributes that bear on the effort needed for use and on the individual assessment of such use, by a stated or implied set of users. Preece stated usability as a measure of the ease with which a system can be learned or used, its safety, effectiveness and efficiency, and the attitude of its users towards it. IEEE explain usability as the ease with which a user can learn to operate, prepare inputs for, and interpret outputs of a system or component.

2.2 Theory of Usability

2.2.1 Theory Nigel Bevan

Nigel Bevan writes the requirement and how to achieve human centered design for ISO 13407. There are other ISO that he created that focus on usability. Some of it are ISO 9241 and ISO 9126.

According to Nigel (2000). ISO 9241 is about ergonomic of human computer interaction. And in this ISO, usability is measure through 3 factor. effectiveness, efficiency and satisfaction. This 3 factor determine how high or low is the usability level. Effectiveness means, how people capable to achieve their desire result with the usability. Which mean that people able to get their goal after they use the products. Efficiency means, how many effort, time that people use in order to understand using products. Satisfaction means, how satisfied people after they use the products

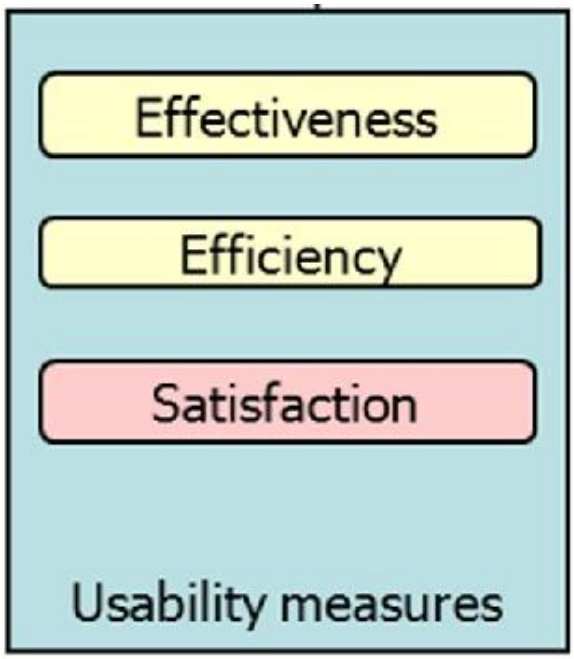

Figure 2.1 ISO 9241 Usability Model

ISO 9126 is about software quality model. How to evaluate quality of software. In this ISO, usability is used to measure software quality. There are 5 factor that determine the usability of software.

- Understandability. It explains that software is capable to be understood by the user. User will understand how the software works.

- Learnability, explain that software should be able to be learnt easily by user. User know how about the software and they able to learn about it. The effort user need to learn about the software.
- Operability. How to software is created based on how user able to operate it. After user understand about the software and they able to learn about it. Then, user will know how to operate and using the software.
- Attractiveness means, how the software looks attractive and pleasing. Whether the design or other things that make user interested on using it.
- Usability compliance means, how software capable to follow rules and regulation, standards that related to usability

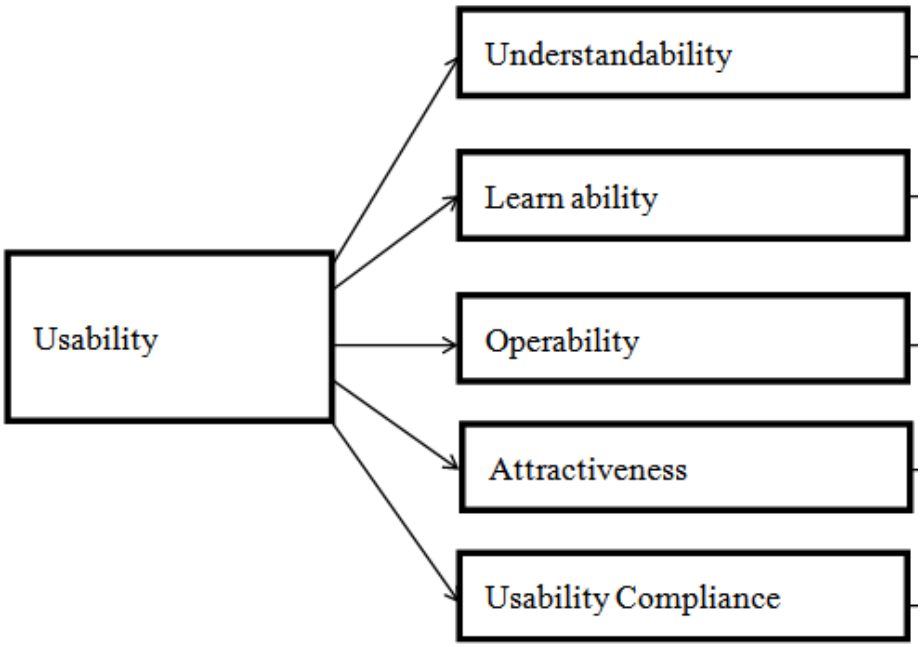

Figure 2.2 ISO 9126 Usability Model

2.2.2 Theory of McCall's Quality Model

According to Quality Models in Software Engineering (2013). McCall create model about measurement quality of software. The determinant of several factors that measure software quality. There are correctness, reliability, efficiency, integrity, usability, maintainability, testability, flexibility, portability, reusability and interoperability. In this research, usability is the one that being used and focused on. Usability is one of the measurement for software quality. It determines if the software have a good quality or not, how the software able to meet with usability requirement. There are 3 factor that determine the usability of software quality. Operability means, how the software is able to be operate by the user. User should be easily operated the software without a lot of effort. Training, means user able to train on using the software without having much difficulties. They can practice and learn using it without having any problem. Communicativeness, means software is being create match with user characteristic. The terminologies and other aspect should be match with human understanding.

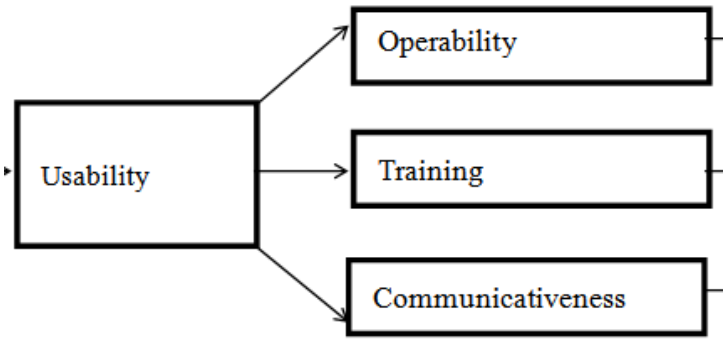

Figure 2.3 McCall's Usability Model

2.2.3 Theory of Nielsen Usability's Model

According to Nielsen (2012). Usability is something that easy to be use and done. It does not take extra effort for doing it. Because, if that platform is not easy to be use, people will not use it and leave it. People do not want to spend much time to study and understanding the platform first, instead the design and content of the platform should be easy to access and use. Usability model consist of 5 factor, there are ease of remembering, efficiency of use, ease of remembering, rate of error during use and subjectively pleasing.

- Ease of learning means, how easy they are able to use software or products and they can easily understand using it
- Efficiency of use means, how quickly people able to do certain task after they learn how to use software or products
- Ease of remembering means, how people able remember the function and usage of software and products after certain period of time
- Few errors during use means number of error while people using software or products. It becomes usable when the rate of error by user is low
- Subjectively pleasing means how pleasant and attractive user find when using software or products.

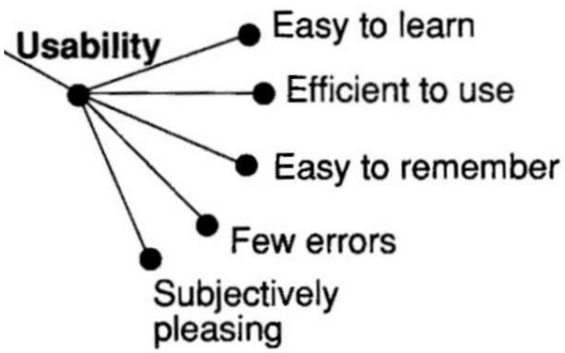

Figure 2.4 Nielsen's Usability Model

2.3 Usability Impact to Satisfaction

Below is the list of paper that prove usability bring positive impact to satisfaction

Author	Title	Sample	Variables	Analysis technique	Results	Conclusion
Cetin and Ozdemir (2013)	A study on an educational's website usability and satisfaction	50 students from different school in Ankara. 30 students from age 9, 20 students from age 10 and 10 students from age 11	Usability, Content, Website quality and User satisfaction	ANOVA	All 3 variables have positive impact toward user satisfaction	Usability of educational website positively influence user satisfaction
Masood and Musman (2015)	The Usability and its Influence of an e-Learning system on Student Participation toward Satisfaction	120 University Sains Malaysia's students. It was separated into novice, average and expert level based on how	Perceived usability, Intention to use and Satisfaction	Multiple linear regression	All variables have positive impact to satisfaction	Usability of e-learning system positively influence satisfaction

		they using the system. Each of it consist 40 people				
Mohd, Yusof and Ahmad (2012)	An Investigation on the Relationship between Online Distance Learning with Learning Usability and Satisfaction	200 students who engage in online distance learning program, in one of public universities in Malaysia	Effectiveness, Efficiency, Perceived usefulness and Satisfaction	Multiple linear regression	All variables have positive impact to satisfaction	Usability of online distance learning positively influence satisfaction
Harrati, Bouchrika, Tari and Ladjailia (2016)	Exploring user satisfaction and usability for e-learning systems	50 lecturer from Computer Science and Electrical Engineering department in different universities. With age	User experience, Usability and Satisfaction	ANOVA	All variables have positive impact toward satisfaction	Usability of e-learning system positively influence user satisfaction

		ranging from 26-65				

Table 2.1 Usability Impact to Satisfaction

In this research, the researcher takes 4 factor of Nielsen usability, which are ease of learning, efficiency to use, rate of error during use and enjoyment. By collecting several papers that prove usability positively influence satisfaction. Researcher comes up with a hypothesis that usability factors lead to satisfaction.

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2.4 Online Learning Platform

Previously technology have not become advanced as now it is. And when people want to learn something or subject, they have go through school, formal course and others. That place cost fee that people have to pay. Sometimes, people have difficulties to do distance learning. People cannot meet directly with the lecturer and vice versa. And then later on, after technology have growth, internet become popular and easily accessed anywhere. Seeing this growth, online learning platform started to grow. There are websites and mobile app for learning. In there, people can find material about subject that they are interested in, apply for it and they will get tutor from there and assignment from it. People are able to learn easily from it. The cost for it also free and there are lot of online learning platform in the internet. For people who do not have enough money, distance learning or managing time, this is the solution that they can find.

Online learning platform is platform that provide learning process in the internet. It is available in desktop (such as pc, laptop and other) and mobile devices. This platform has lecture, student and other people to support on the learning system. According to Fordham University (2015), there are 3 types of online learning:

- **Synchronous learning**: process of learning where lecture and student have interaction at the same time. In form of chatting and video call that happen in real time. Like in a real

classroom. So, students are not learning by themselves, instead they able to communicate with the lecturer. Student can directly ask a question and lecturer answer it, vice versa. In this type of learning students have to spend specific time for the learning session and more interactive by having interaction with the lecturer

- **Asynchronous learning**: process of learning where students do not directly have interaction with the lecturer. Students will be given course material and assignment through website, email and other. They do not have to worry about what time they should spend for the lecturer, instead they can set time when to learn material and do assignment. In this learning, students will learn by themselves and usually using the internet to find and learn about their courses. However, they should be able to motivate themselves when they have to study and do the assignment. Otherwise, it will not give any benefit.
- **Hybrid learning**: process learning that combine between synchronous and asynchronous learning. Students able to meet face to face with lecturer in real life several times. And the rest, students using online media to get the course material, assignment. Chatting and video call to interact with the lecturer

2.4.1 Duolingo

Duolingo is a free online language learning platform that are available in desktop and mobile app. There are 68 languages that user can choose to learn. When user use this platform, they can choose whether to create account or not. If they create account, they will be able to save their progress. According to thebalance.com (2017), Duolingo is one of the best free language application. It provides interesting way of learning experience to the user. It provides text, image and sound that catch user's attention. There is certain level in the platform. First, user will start at the basic and later on the material will become more advanced. Now Duolingo have 150 million users around the world

Duolingo was created by Professor Luis von Ahn and Severin Hacker. The project was started in 2009 and the first private beta created in 2011. Finally, in 2012, Duolingo was released to public from their desktop website and IOS devices. In 2013, They launch Duolingo in android devices. Duolingo received huge interest from public and received many investments. Below is the screenshot of Duolingo application for website and mobile.

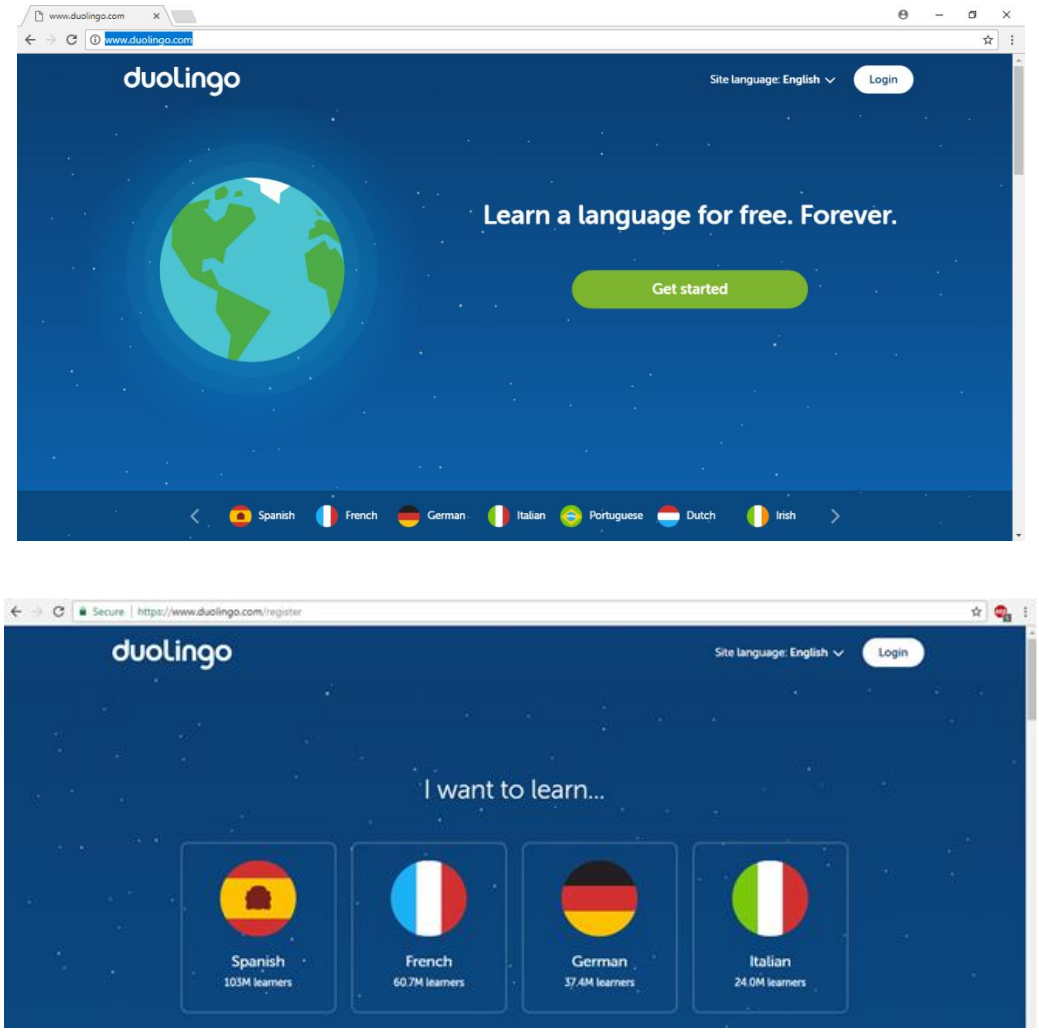

Figure 2.5 Duolingo in Website

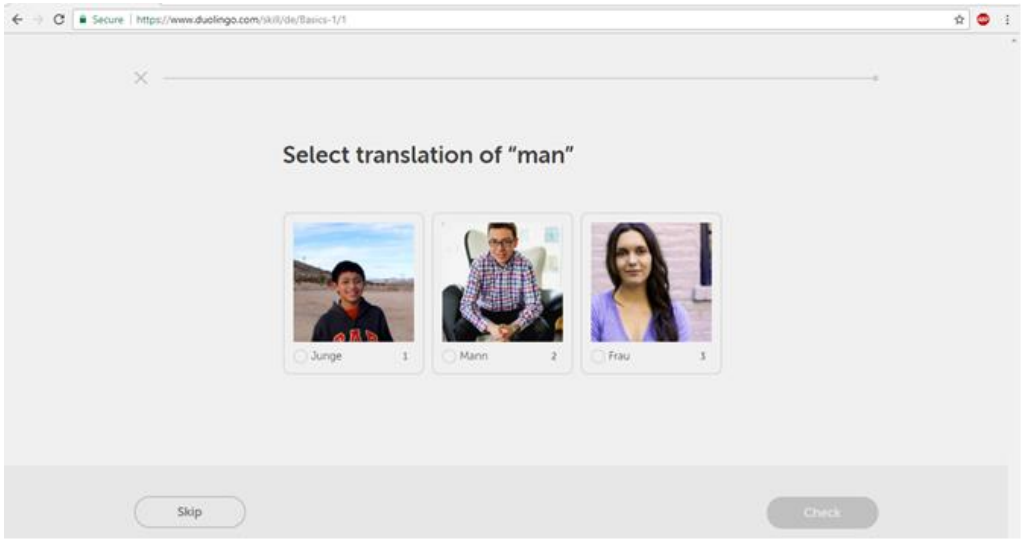

Figure 2.6 Duolingo in Website (2)

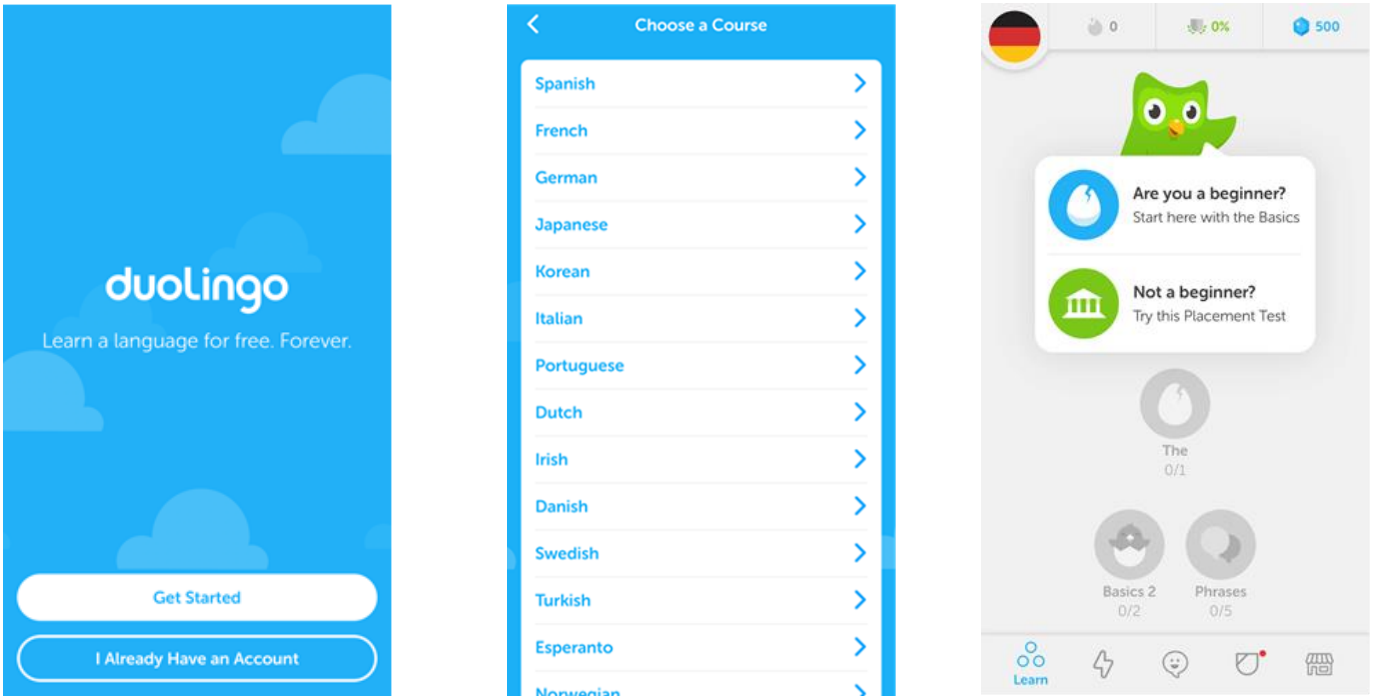

Figure 2.7 Duolingo in Mobile