The Impact of Gender and Locus of Control Differences on Hyperlinked Content Used

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Abstract

Expected content and serendipitous hyperlinked content are common in Wikipedia articles and may motivate users to either solve or explore problems. This study aimed to understand the impact of hyperlinked content on the behavioral intention to use Wikipedia articles from the perspectives of different genders and locus of control (LOC). A quantitative survey of 235 respondents was used to assess students' intentions to use Wikipedia at a certain time based on their usage and behavior. Statistical analysis revealed that hyperlinked expected content significantly influenced users' behavioral intention for problem-solving, while hyperlinked serendipitous content was significant for problem exploration. Problem-solving is considered as the strongest behavioral intention to use Wikipedia, especially for users to become future users. This study reveals that internal LOC causes males to feel that hyperlinked serendipitous content is important, while females feels more of the importance on hyperlinked expected content. Moreover, only males with external LOC use Wikipedia for problem-solving. This study also suggests that males with internal LOC and females with external LOC use Wikipedia in their fraction time to explore hyperlinked serendipitous content.

Keywords: Wikipedia, Hyperlinked contents, e-Learning, Locus of control, Gender differences

1 Introduction

Wikipedia represents one of the largest and most recognizable reference resources of our current time [1] and plays an important part in education. University students use Wikipedia not only as an academic resource but also as an instrument to participate in collaborative learning in virtual communities [2]. Although Wikipedia might be considered as a learning platform, it is indeed an information or knowledge sharing and collaborative platform. Wikipedia includes almost all kinds of knowledge and is shared with the public. Although it is not necessarily accurate, it is plain and easy to understand and affects the market [3].

Because of its popularity, this study assumes that there are certain expectations toward Wikipedia content and its hyperlinks. A hyperlink can connect an article to another on Wikipedia's massive database, and researchers have used Wikipedia for studies in semantics [4-5] and data mining [6]. This study believes that studying Wikipedia's hyperlinked contents is a good case of the hyperlinks usage on knowledge sharing platform.

Hyperlinks can help users to find their expected information, but the accidental discovery of new knowledge is inevitable. Wikipedia is a collaborative learning tool featuring many user-generated articles and various unique subjects [7]. Users can effortlessly encounter new information that is serendipitous and may be useful to them. Serendipity is defined as an unexpected experience prompted by an individual's valuable interaction with ideas, information, objects, or phenomena [8]. Few investigations have focused on serendipity on Wikipedia [9-10], and lack explanation has been provided for the primary source of serendipity, which this study argues arises from hyperlinks.

At the same time, the learning flow through any information technology has always been a problem. There is a need to find out what makes a user keep their attention on a specific learning platform and continue using it. As defined in the Attention Economy Theory (AET), there are three aspects of attention: the gap when attention is idle, the twenty-four hour time limitation, and the opportunity cost [9]. These timely aspects reflect how technology strives to get the most of users' attention and create a flow. The key is the contested time for gaining users' attention.

This study argues that, in creating a learning flow and intention to use learning technology, users must perceive three aspects of learning at any time based on the AET aspects of attention. The aspects are learning in users' fraction time, locked as a future learner, and learning over an extended period. However, no studies to date have examined time as a factor in the use an online encyclopedia. This study examined Wikipedia usage in users' fraction time, for a long period, and in the future.

Moreover, a study investigated the role of internet

skills in contributions to Wikipedia and found a gender gap in Wikipedia usage [10]. A prior study revealed significant differences between genders on six web 2.0 applications, one of them being Wikipedia [11]. Females tend to become submissive on the external environment, but males tend to be more in control over their environment [12]. Such environmental control beliefs are called locus of control (LOC) [13]. LOC has been studied by prior researchers on its effects on education [14-15] and its judgment toward useful experience [13]. However, no studies to date have addressed gender and LOC differences during the use of certain technologies for learning. This study believes that females can also be in control over the learning environment, and some males can be submissive toward learning activities. These characteristics may affect the use of hyperlinked content. For instance, females and males with the same internal LOC may have a different result on how they perceived expected or serendipitous content for problem-solving and problem exploration. Thus, gender and LOC are used in this study as moderators, which may give better understanding how each person navigate to use Wikipedia for problem-solving and exploration.

It is important to note that understanding different characteristics is essential for learning designers to create a comprehensive tool for learners in the twenty-first century. Therefore, to better understand the use of hyperlinked content on Wikipedia, this study aimed to investigate the factors in Wikipedia navigation control that directly or moderately influence its actual use. Based on the research question, as seen in Figure 1, this study hypothesized that :

H1.   Hyperlinked expected content positively influences problem-solving.

H2.   Hyperlinked expected content positively influences problem exploration.

H3.   Hyperlinked serendipity content positively influences problem-solving.

H4.   Hyperlinked serendipity content positively influences problem exploration.

H5.   Problem-solving positively influences actual use.

H6.   Problem exploration positively influences actual use

H7a.   Gender and LOC moderate the influence of hyperlinked expected content to problem-solving.

H7b.   Gender and LOC moderate the influence of hyperlinked expected content to problem exploration.

H7c.   Gender and LOC moderate the influence of hyperlinked serendipity content to problem-solving.

H7d.   Gender and LOC moderate the influence of hyperlinked serendipity content to problem exploration.

H8a.   Gender and LOC moderate the influence of problem-solving to actual use.

H7b.   Gender and LOC moderate the influence of problem exploration to actual use.
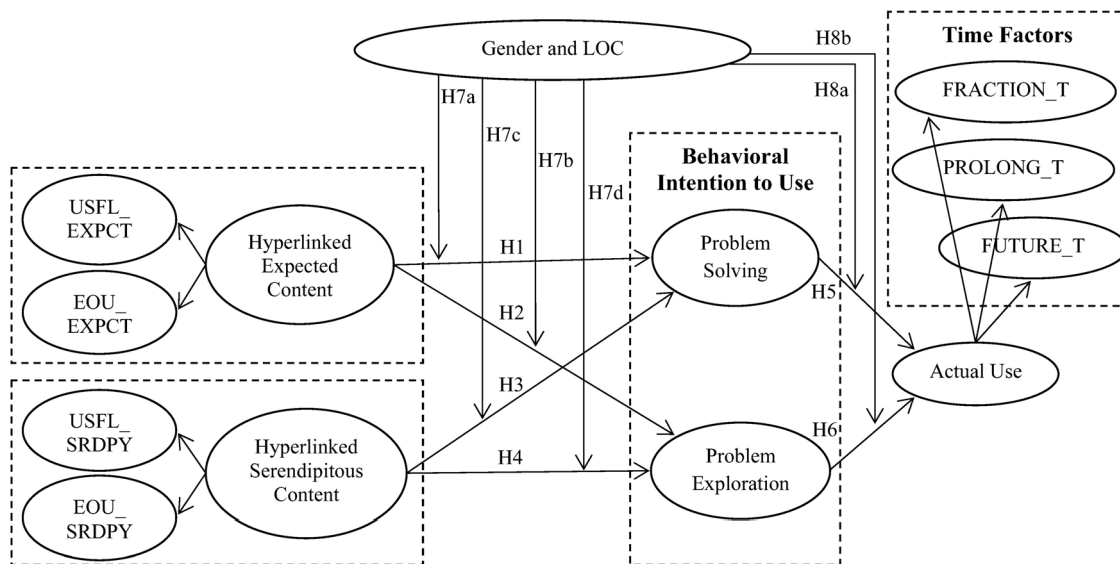
USFL_EXPCT: Usefulness of Hyperlinked Expected Content; **EOU_EXPCT**: Ease of Use of Hyperlinked Expected Content; **USFL_SRDPY**: Usefulness of Hyperlinked Serendipitous Content; **EOU_SRDPY**: Ease of Use of Hyperlinked Serendipitous Content; **HYPER_EXPCT**: Hyperlinked Expected Content; **HYPER_SRDPY**: Hyperlinked Serendipity Content; **P_SOLVE**: Problem Solving; **P_EXPLR**: Problem Exploration; **USE**: Actual Use; **FRACTION_T:** Fraction Time; **PROLONG_T:** Prolonged Stay Time; **FUTURE_T:** Lock-in Future User

Figure 1. Hypotheses structural model

Following the introduction of this paper, the review of related studies and their relation to research hypotheses was organized in Section 2. Research methodology was described in Section 3. Results were presented in Section 4, followed by the discussion in Section 5 and the conclusion in Section 6.

2 Literature Reviews

2.1 Expectation and Serendipity as Navigation Control

As of December 2018, Wikipedia contained over 49.3 million articles and continues to increase over time [16]. That large number may influence users' expectations of finding information on Wikipedia. Expectations express the needs of functionality and performance in the form of outcomes, products, and services [17]. Recent studies have examined expected information in clinical information [18] and social media [19]. However, the hyperlinks on Wikipedia play an important role. The hyperlink structures connecting article pages represent the connections among terms [6], which can help users to navigate through Wikipedia. Although users can find their expected information easily, they also likely to encounter unexpected information, which can drive serendipity.

Serendipity is defined by Cunha et al. [20] as the accidental discovery of something that, post hoc, turns out to be valuable. Serendipity is used to describe its influence on human behavior [20-21]. On Wikipedia, users may experience the accidental discovery of something good or useful while not especially searching for it [22]. McCay-Peet et al. [8] mentioned three characteristics of serendipity, namely, being trigger-rich, enabling connections, and leading to the unexpected. They defined being trigger-rich as 'the degree to which a digital environment contains a variety of information, ideas, or resources that are interesting and useful to the user' [8]. Enabling connections was defined as 'the degree to which a digital environment makes relationships or connections between information, ideas, or resources apparent' [8]. Leading to the unexpected is defined as 'the degree to which a digital environment provides opportunities for unexpected interactions with information, ideas, or resources' [8]. Wikipedia is a system that provides these three characteristics of serendipity through hyperlinked serendipitous content.

The characteristic of navigating Wikipedia by using hyperlinks is displayed by users' expectations, which may result in serendipity. Therefore, this study defines hyperlinked expected and serendipitous content as Wikipedia navigation control. It describes how users navigate through hyperlinks to get useful, easy-to-use content. In this study, usefulness and ease of use are employed as defining factors in both hyperlinked expected and serendipitous content. The purpose is to understand which factors have greater importance to expected and serendipitous hyperlinks. This study argues that the degree of expectation and serendipity alone are not enough to know whether the content can be used as a problem-solving or problem exploration's materials since the hyperlinked content must be useful or easy to use.

2.2 Motivation as A Behavioral Intention to Use

Previous studies have investigated motivations to use Wikipedia, such as self-development and altruism [23] and internal self-concept [24]. However, this study argues that the motivation lies in users having questions and wanting to seek the answers. Problem-solving is defined as 'a process by which the learner discovers a combination of previously learned rules that he/she can apply to achieve a solution to a new situation' [25], and recognized as part of the learning process [26]. Bransford and Stein [27] introduced the so-called problem-solving cycle. The cycle consists of problem recognition, problem definition, strategy development, knowledge organization, resource identification, progress monitoring, and solution evaluation [27]. However, this cycle does not have to be followed in that order. With the help of Wikipedia's hyperlinked content, users can easily find expected knowledge to solve or explore their problems, before completing the stage of strategy development to organize knowledge.

2.3 The Attention Economy Theory

The use of ubiquitous technology is increasing in this internet era, which enables users to obtain various digital contents through mobile devices anytime and anywhere. The dependency on the technology of the global population is undeniable. An estimated 28% of the workday is consumed by interruptions propagated by technology, that cost the US economy approximately $588 billion each year [28-29]. Moreover, a study revealed that 80% of the time spent by users on the internet each day is for social media, entertainment, productivity apps, and news [30]. Other purposes, such as shopping and learning, compete for the other 20%. Thus, time is a limited resource and contested for attention.

In AET, attention has three characteristics: (1) a notch or gap, where attention is idle, as when downloading files; (2) limitation, where time consists of only 24 hours per day; and (3) opportunity cost, where there is no internet involved, as when watching movies [9]. The attention economy motivated participation in peer-produced sites on the Web such as YouTube and Wikipedia [31]. The key to the attention economy is the use of time.

This study extends AET characteristics into three primary determinants that focus on the use of time in users' fraction time, a prolonged stayed time, and users to be locked as future users. Fraction time is defined as a situation in which people have a limited amount of time in their idle attention [32], for instance while reading emails, waiting for the train, drinking morning coffee, etc.

Prolonged stay time is defined as a situation in which people act with concentration and deep involvement, which results in a long period of using technology [32]. Another word of deep involvement with concentration is a flow state, or defined as 'the state occurring during network navigation which is characterized by a seamless sequence of responses facilitated by machine interactivity, intrinsically enjoyable, accompanied by a loss of self-consciousness, and self-reinforcing' [33]. With the massive resources that Wikipedia can provide, users may be able to continue explore information through hyperlinks. Especially, when they are motivated to solve a certain question.

While fraction time and prolonged stay time are two determinants that focus on the use of a technology at a current time, locking-in future user is a future-focused determinant. It refers to the users' determination or intention to use the system again in the future after first-time use [32]. Engaging on learning activities on Wikipedia, even only in a form of problem-solving, may effect on users' perception toward a technology and its actual use in the future.

An actual use has been studied by many and there is a significant influence found from behavioral intention [34-35]. Thus, this study clustered three variables of time into the actual use of Wikipedia, to better understand the actual usage on different time while performing problem-solving and problem exploration.

2.4 Gender and Locus of Control Differences in Learning

There are different perceptions of the outcome expectation, information quality, faith in Wikipedia, emotional state, and confidence in evaluating the information quality between gender [36]. Gender could also affect learning achievement, motivation, and engagement [37]. Moreover, prior studies have revealed a gender gap on Wikipedia [38] and different emotional states between genders during its use [11].

Males are perceived to be stronger than females in the areas of rationality, strength, activeness, braveness, and self-efficacy [13]. Females are perceived to be more responsible for maintaining social ties and being sensitive to others' needs and expectations [39]. For many years, studies have also identified significant differences in how males and females behave toward a particular technology [37, 40-41]. Thompson and Lim [41] studied the gender gap and suggested that PCs are easier to use for males than for females. Another study also revealed that females are more confident than males in using computers [42]. Moreover, males have higher e-learning acceptance, computer self-efficacy, perceived usefulness, perceived ease of use, and behavioral intention to use [43].

Most studies have focused on gender as a biological means of differentiating how people behave, not on the characteristics of each gender. For instance, femininity and masculinity are not identified as characteristics of males or females, but as personality traits in each person [44]. Males are believed to be more competent and experience than females in using computers and tend to use the internet more than females do [11]. Moreover, females felt more anxious than males did about using web 2.0 applications [11]. However, only using gender to explain how students behave toward a particular technology for learning is not sufficiently accurate, for other factors might affect such behaviors.

As noted by Moreno and Richard [12], women are more likely to think of themselves as being submissive and harmonious with the environment, whereas men are more likely to think of themselves as dominant and in control of the environment. Beliefs in how controllable and responsive the environment is called Locus of Control [45-46]. LOC divides humans into two different types of beliefs, namely, those with internal LOC and those with external LOC. People with internal LOC judge what happens to them by their behavior and perceive their behavioral outcomes as contingent on their experiences, even if there is no possibility of control [13, 47]. Conversely, people with external LOC believe that external powers control their environment and that it is impossible to control what will happen. Previous researchers have studied LOC in education [14-15] and product experience [13].

No studies to date have examined gender and LOC as moderators in e-learning studies. This study believes that the influence strength of navigation control to behavioral intention may differ on different user characteristics. For instance, males who are more rational than females, although both have the same internal LOC which judging a search result based on their effort, may prefer to have an expected content to do a problem-solving. Whereas, the females may prefer to use it for problem exploration.

This study argues that combining gender and LOC to examine a moderation effect between usage and behavioral intention on Wikipedia will result in a more in-depth investigation of behaviors toward a learning technology.

3 Methodology

A quantitative method was used in this study to gather statistical data that would facilitate the examination of the hypotheses. A prior study used a quantitative methodology to determine a person's behavior using special instruments [47]. The collected data were analyzed with statistical procedures through hypothesis testing.

3.1 Measurement of the Study

A structured questionnaire was developed with demographic items, and twenty-eight main questionnaire items were adapted from a wide range of reviewed

literatures (see Appendix 1). The survey elements of the usefulness and the ease of use were grouped based on HYPER_EXPCT and HYPER_SRDPY. The problem-solving items were grouped on HYPER_EXPCT due to the high expectation level in solving problems. On the other hand, problem exploration was arranged into HYPER_SRDPY because of the strong possibility of finding unexpected information.

From the twenty-eight main questionnaire items, twenty-one items were scored on a five-point Likert-type scale ranging from 1 (strongly agree) to 5 (strongly disagree). The other seven items related to LOC were adapted from the Nowicki-Strickland LOC Scale for adults [48]. The demographic items included gender, age, education degree, and Wikipedia experience, ranging from one (always) to five (never).

3.2 Demographic Samples

Data samples were collected from 235 Taiwanese students at the National Taiwan University of Science and Technology. The study sample included 98 males (41.7%) and 137 females (58.3%). The majority of respondents sometimes used Wikipedia for daily use (54.47%, N=128). About one third (32.77%; N=77) often used Wikipedia, and 12.77% (N=30) rarely used

it. The population majority were college students (96.17%) and less than 20 years old (89.79%).

4 Results

Partial Least Square (PLS) was applied for the measurement of the structural equation model (SEM). Confirmatory factor analysis was conducted on the 235 valid data. An independent two-sample t-test was performed to evaluate the significance of the mean difference between variables on different types of people and as support for the SEM results.

4.1 Measurement Model

Table 1 presents the descriptive statistics of all measurement items. HYPER_EXPCT and HYPER_SRDPTY items were formulated by the combination of respected determinants of usefulness and ease-of-use. FUTURE_T, PROLONG_T, and FRACTION_T were grouped into USE. The absolute values of skewness and kurtosis were calculated to assess the normality of responses obtained, with a cutoff of an absolute value of 2.3 [49].

Table 1. Descriptive statistics

Constructs	Items	Mean	Standard Deviation	Skewness	Kurtosis	Factor Loading
HYPER_EXPCT	EOU_EXPCT1	3.826	0.685	-0.405	0.375	0.854
	EOU_EXPCT2	3.851	0.709	-0.285	0.027	0.788
	USFL_EXPCT1	3.928	0.767	-0.449	0.314	0.870
	USFL_EXPCT2	3.664	0.912	-0.444	0.043	0.874
HYPER_SRDPY	EOU_SRDPY1	3.664	0.791	-0.056	-0.463	0.866
	EOU_SRDPY2	3.660	0.759	0.009	-0.417	0.804
	USFL_SRDPY1	3.668	0.757	-0.257	0.140	0.889
	USFL_SRDPY2	3.600	0.823	-0.115	-0.033	0.888
P_SOLVE	P_SOLVE1	3.549	0.843	0.061	-0.391	0.923
	P_SOLVE2	3.604	0.785	0.025	-0.174	0.905
P_EXPLR	P_EXPLR1	3.515	0.813	0.096	-0.012	0.927
	P_EXPLR2	3.489	0.753	0.369	-0.297	0.902
USE	FUTURE_T1	4.098	0.834	-0.765	0.151	0.821
	FUTURE_T2	3.621	0.866	-0.060	-0.480	0.801
	FUTURE_T3	3.791	0.824	-0.243	-0.479	0.799
	PROLONG_T1*	2.885	0.877	0.073	0.210	0.181
	PROLONG_T2*	2.821	0.764	-0.092	-0.219	0.126
	PROLONG_T3*	2.694	0.837	-0.033	-0.020	0.135
	FRACTION_T1	3.791	0.742	-0.214	-0.201	0.810
	FRACTION_T2	3.834	0.786	-0.390	-0.122	0.767
	FRACTION_T3	3.962	0.829	-0.519	-0.201	0.743

Note. *PROLONG_T items were eliminated due to the incompatible loading values.

Previous studies have suggested that all factor loadings should exceed 0.5, composite reliability should exceed 0.7, and average variance extracted (AVE) should exceed 0.5 [50]. As shown in Table 2, most constructs indicated reliable responses. However, PROLONG_T items have insignificant loadings' value, thus the construct was eliminated in the next stage of the research. Moreover, the square root of AVE should

be higher than the corresponding correlation coefficient to assess the discriminant validity [50]. Table 3 shows that all diagonal entries had satisfactory discriminant validity. Furthermore, the correlation indicated that the relations of HYPER_EXPCT to P_SOLVE and HYPER_SRDPY to P_EXPLR were the highest.

Table 2. Reliability and convergent validity

Constructs	Items	Factor Loading	Cronbach's α	AVE	Composite Reliability
HYPER_EXPCT	EOU_EXPCT1	0.854	0.869	0.718	0.910
	EOU_EXPCT2	0.788			
	USFL_EXPCT1	0.870			
	USFL_EXPCT2	0.874			
HYPER_SRDPY	EOU_SRDPY1	0.866	0.885	0.744	0.921
	EOU_SRDPY2	0.804			
	USFL_SRDPY1	0.889			
	USFL_SRDPY2	0.888			
P_SOLVE	P_SOLVE1	0.923	0.804	0.836	0.911
	P_SOLVE2	0.906			
P_EXPLR	P_EXPLR1	0.927	0.806	0.837	0.911
	P_EXPLR2	0.903			
USE	FUTURE_T1	0.813	0.883	0.630	0.911
	FUTURE_T2	0.767			
	FUTURE_T3	0.751			
	FRACTION_T1	0.828			
	FRACTION_T2	0.802			
	FRACTION_T3	0.801			

Table 3. Correlation matrix and discriminant validity

	AVE	HYPER_EXPCT	P_EXPLR	P_SOLVE	HYPER_SRDPY	USE
HYPER_EXPCT	0.718	**0.847**				
P_EXPLR	0.837	0.545	**0.915**			
P_SOLVE	0.836	0.717	0.691	**0.914**		
HYPER_SRDPY	0.744	0.671	0.720	0.569	**0.863**	
USE	0.630	0.698	0.574	0.644	0.609	**0.794**

4.2 Structural Model

As shown in Figure 2, expectation in HYPER_EXPCT (β=0.61, p<0.001) positively influenced P_SOLVE (R^2=0.528), where serendipity in HYPER_SRDPY (β=0.64, p<0.001) positively affected P_EXPLR (R^2=0.525). There was no cross-relation effect on expected contents to problem exploration, nor serendipitous contents to problem-solving. As presented in Figure 2, P_SOLVE (β=0.47, p<0.001) and P_EXPLR (β=0.25, p<0.05) significantly affected USE. However, although exploration was considered more interesting due to serendipitous information, users were more likely to do problem-solving.
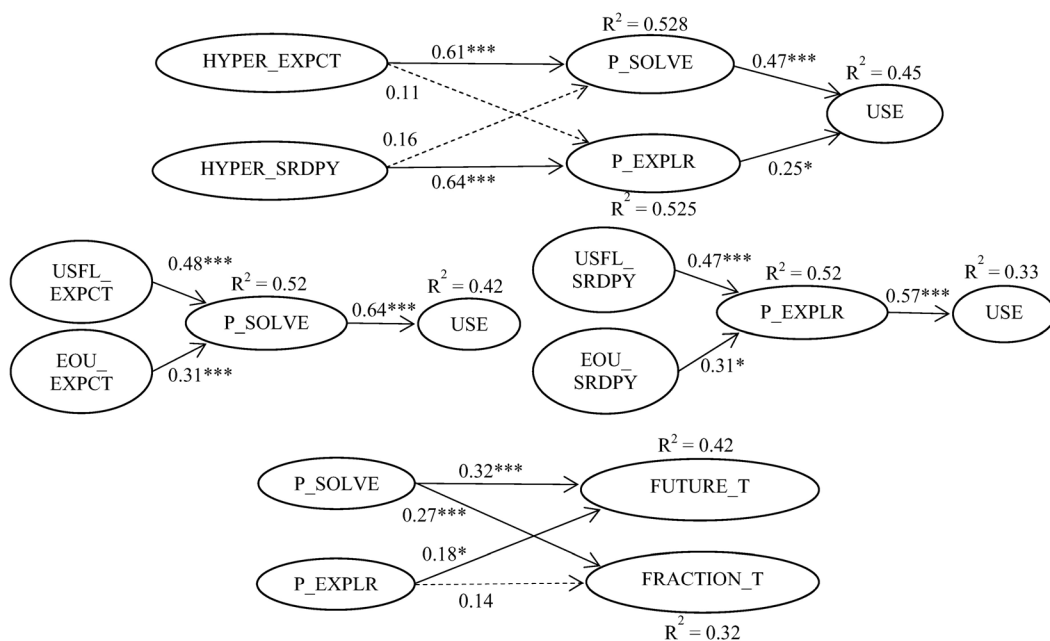

Figure 2. Structural model analysis

This study also analyzed the factors that can influence the variables in each significant relationship. As shown in Figure 2, P_SOLVE was significantly affected by USFL_EXPCT ($\beta=0.48$, $p<0.001$) and EOU_EXPCT ($\beta=0.31$, $p<0.001$). On the other hand, P_EXPLR was positively affected by USFL_SRDPY ($\beta=0.47$, $p<0.001$) and EOU_SRDPY ($\beta=0.31$, $p<0.05$). These results indicate that both usefulness and ease of use influence behavioral intention to use Wikipedia. The results also imply that usefulness is more important for users than ease of use.

Furthermore, this study examined the relationship between behavioral intention to use and actual use. Interestingly, users were locked in as future users ($R^2=0.42$) if they perceived behavioral intention to use through P_SOLVE ($\beta=0.32$, $p<0.001$) and P_EXPLR

($\beta=0.18$, $p<0.05$). Meanwhile, Wikipedia usage in users' fraction time ($R^2=0.32$) was influenced only by P_SOLVE ($\beta=0.27$, $p<0.001$).

4.3 Moderating and Subgroup Effects

Table 4 presents the SEM matrix for gender and LOC subgroups. The results indicated that most supporting models supported significant relationships between navigation controls and behavioral intention to use, except males with external LOC, who would use Wikipedia only for problem-solving. The high importance of HYPER_SRDPY to P_EXPLR was also supported by most subgroups, except females with internal LOC.

Table 4. Subgroups matrix
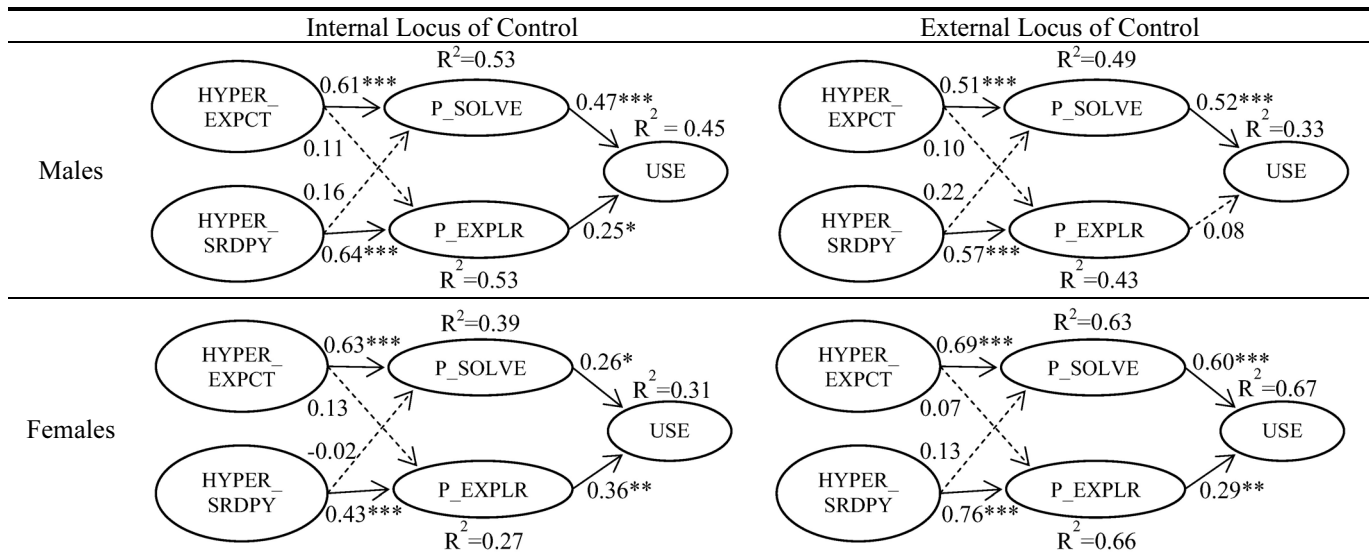
Moreover, as shown in Table 5, whether the hyperlinked content was expected or serendipitous, the results revealed the importance of usefulness to behavioral intention for all subgroups. The subgroup results also supported the significant influence of usefulness and ease of use to behavioral intention, except in internal LOC. Internal LOC males only expected useful content for P_SOLVE ($\beta=0.698$, $R^2=0.573$), but utilized both serendipitous variables for

P_EXPLR ($R^2=0.695$). Conversely, females had the opposite thought: the USFL_SRDPY significantly influenced P_EXPLR ($\beta=0.415$, $R^2=0.268$), but they expected both expectation variables on P_SOLVE ($R^2=0.386$). Interestingly, another significant relationship in the supporting models did not occur in the primary model, namely, that between P_EXPLR and FRACTION_T.

Table 5. Subgroup moderator effects

Constructs	Male & Internal LOC β	R2	Male & External LOC β	R2	Female & Internal LOC β	R2	Female & External LOC β	R2
N	44		54		61		76	
USFL_EXPCT → P_SOLVE	0.698***	0.573	0.408**	0.472	0.368 ***	0.386	0.450***	0.619
EOU_EXPCT → P_SOLVE	0.100		0.370**		0.318 **		0.395***	
USFL_SRDPY → P_EXPLR	0.705***	0.695	0.314***	0.429	0.415 **	0.268	0.455***	0.656
EOU_SRDPY → P_EXPLR	0.171*		0.417***		0.142		0.410***	
P_SOLVE → FUTURE_T	0.542***	0.422	0.540***	0.291	0.263 *	0.313	0.573***	0.621
P_EXPLR → FUTURE_T	0.129		A		0.364 **		0.275***	
P_SOLVE → FRACTION_T	0.360**	0.492	0.4999***	0.249	b		0.516***	0.504
P_EXPLR → FRACTION_T	0.377*		a		b		0.248*	

Note. [a] P_EXPLR is insignificant for USE as shown in Table 4; [b] FRACTION_T items have incompatible loading values.

A two-sample independent t-test was also conducted to compare each construct for different types of personalities to support the subgroup models' results shown in Table 4 and Table 5. A prior study suggested that p-value should less than 0.05 [47]. Table 6 shows a statistically significant difference in all constructs between males and females with internal LOC. The significant difference also found in males with internal

($\mu=3.69$, SD=0.76) and external LOC ($\mu=3.40$, SD=0.69) on P_EXPLR (t(96)=2.01, p=0.05). Moreover, there were also a statistically significant differences in females with internal and external LOC on all constructs except P_SOLVE (t(135)=-1.65, p=0.10) and P_EXPLR (t(135)=-1.82, p=0.07). These results support the importance of gender and locus of control in the use of Wikipedia in a time-based model.

Table 6. Mean differences between subgroups

	HYPER EXPCT		HYPER SRDPY		P_SOLVE		P_EXPLR		USE	
	μ	p	μ	p	μ	p	μ	p	μ	p
Male and Internal LOC	3.97	**0.01**	3.78	**0.02**	3.78	**0.01**	3.69	**0.01**	3.62	**0.01**
Female and Internal LOC	3.64		3.49		3.42		3.36		3.38	
Male and External LOC	3.78	0.34	3.61	0.35	3.51	0.35	3.40	0.17	3.48	0.50
Female and External LOC	3.89		3.73		3.63		3.58		3.54	
Male and Internal LOC	3.97	0.14	3.78	0.21	3.78	0.06	3.69	**0.05**	3.62	0.15
Male and External LOC	3.78		3.61		3.51		3.40		3.48	
Female and Internal LOC	3.64	**0.03**	3.49	**0.04**	3.42	0.10	3.36	0.07	3.38	**0.05**
Female and External LOC	3.89		3.73		3.63		3.58		3.54	

5 Discussion

The structural relationships among hyperlinked expected and serendipitous content, and behavioral intention to solve and explore problems to understand the actual use of Wikipedia in terms of different gender and locus of control. The actual use of Wikipedia is explained by time-based variables, namely, the lock-in of future users, prolonged stay time, and fraction time. A quantitative methodology was employed to attain statistical data for hypothesis testing.

5.1 Expectation and Serendipity Toward Behavioral Intention

As shown in the statistical results, the behavioral intention for solving and exploring problems is influenced more by serendipity, rather than by expectation. Serendipity drives information exploration through hyperlinks. Importantly, the results must be useful to continue the exploration, for all user characteristics.

These results revealed the perspective of how people solve problems. One of the cycles of problem-solving is gathering and combining information to find the best-fit solution to problems [27]. This study finds that users see hyperlinked serendipitous content as a way to gather much information and explore it to solve problems. Usefulness of information, whether it is shown as expected content or serendipitous, are considered as the most important factor on why such user perceived a unique behavioral intention.

However, the strength of such relationship differs for different gender and LOC. Females expected useful and easy to use information for problem-solving, because they tend to be more risk-sensitive [36] and

utilize the internet to get support for problem-solving [45]. However, females with internal LOC tends to avoid risk and to believe in herself rather than outside influences [51]. These characteristics create a tendency to explore problems only to find useful serendipitous information, without consideration of the information's ease of use.

In contrast, males with internal LOC have a combination of risk-taking and self-belief, which resulted in the use of Wikipedia for broader topics. This combination led to more search-clicks not only to gain additional useful information for problem-solving, but also to gain more useful and easy-to-use information for problem exploration, whether the hyperlinked content is expected or serendipitous.

On the other hand, both genders with external LOC perceived the importance of hyperlinked expected content in problem-solving and that of hyperlinked serendipitous content in problem exploration.

5.2 The Actual Use of Wikipedia

A prior study stated that behavioral intention is the ultimate predictor of actual behavior [52]. The results of this study is another proof that in the use of learning technology, behavioral intention has a positive influence on the actual use. However, this study argues that there is more in the definition of behavioral intention and its relation to the actual use. The intention use is reflected in users' behavior on trying to solve and explore problems on Wikipedia. However, the actual use itself is questioned and argues that time is an important factor when it comes to learning.

The results suggest that users were likely to use Wikipedia on the fraction time only if they want to do a problem-solving. These result shows that Wikipedia can provide users with information availability, to be used on users' spare time, for instance on idle time

while on a train. This experience led to users to be locked as future users.

Gender and LOC were found to have moderating effects on actual use. However, no matter which user characteristic use Wikipedia, there is a relationship that is always positive although the strengths are moderated and differed, which is between problem-solving and locked-in future user. The hyperlinked content given can be a recluse when it can be used as a problem-solver, which may implicate on how users perceived Wikipedia and its usage in the future.

Although Wikipedia was perceived as a problem-solver by both genders, it also perceived as a media for exploration only by females when it comes to them as a future user. Because females are risk-sensitive, they tend to explore first before deciding which information is fit, unlike the counterpart who tend to be risk-takers.

Differences on how users utilize Wikipedia on their fraction times are reflected on LOC differences. Both genders with external LOC and males with internal LOC were solving problems in their spare time. For instance, during a lunch-break, laid-back situation, etc.

These results arose because males tend to be logical and goal-oriented. Adding external LOC to males' personalities makes them more easy-going than their counterparts with internal LOC. As a result, their actual use of Wikipedia occurs in their limited time for problem-solving alone, while for problem-exploration, they intentionally use other time. In contrast, males with internal LOC will never believe in outside forces, which makes them more likely to use their fraction time for both problem-solving and exploration.

In the case of females, only females with external LOC used Wikipedia in their fraction time for both problem-solving and exploration. The reasons could be that females tend to be more skeptical toward information given to them and that adding internal LOC beliefs creates a preference for using Wikipedia only for problem-solving in their precious limited time. In contrast, females with external LOC see themselves as powerless over their situation [40] and have been associated with a worldview that reduces the value of effort on the part of the individual for goal attainment [53]. This perspective might create a sort of time ignorance, meaning that they do not care whether they use fraction time or full time to solve and explore problems. They believe that however and whenever they try to find the solutions to their problems, they will find it eventually with the help of an outside force, which in this case is Wikipedia.

6   Conclusion

A quantitative methodology was employed to answer current research question. The findings suggest that users used Wikipedia in their fraction time and locked as future users. Problem-solving and problem-exploration play important roles as behavioral

intentions to use Wikipedia. Moreover, hyperlinked expected content is important for problem-solving, while hyperlinked serendipitous content is significant for problem exploration. The results also provide clear evidence that gender and LOC moderate the influences. Each personality type will react differently toward behavioral intention and the actual use.

6.1   Implications

This study contributes to the existing literature and similar research areas. First, the moderation of gender and LOC are important aspects for understanding a person's behavior on utilizing his or her environment, especially in the use of education technology. Second, AET is the base theory for the time usage variables in this study, such as use in fraction time, prolonged stay time, and future use. However, not all time variables can work for certain technologies or specific purposes. In learning technology such as Wikipedia, prolonged stay time does not work due to the missing fun factor in learning, but it might work on other platforms for different purposes, such as e-commerce and social media. Third, this study also highlights the importance of the relationships among navigation control, behavioral intention, and actual use.

Moreover, learning platform designers such as teachers and technology developers can use this study as a reference to develop or improve their education services. Educational content that meets expectations is important for problem-solving, but unexpected information is also important for increasing users' interest in learning something new. The most important consideration is to create educational platforms that can be used anytime (e.g., in users' fraction time, prolonged stay time, and the future).

6.2   Limitations and Future Research

Several limitations of this study need to be addressed. Most of the respondents in this study were first-year college students, who might have used Wikipedia less than senior students daily. Therefore, their usage experiences may be considered as a moderating variable in future studies. Also, this study could not investigate further the implications of prolonged stay time in the use of Wikipedia. Future studies may explore prolonged stay time on other educational platforms (e.g., MOOCs) and research areas (e.g., social media, news, and e-commerce).

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Appendix

Appendix 1. Questionnaire Items

Hyperlinked Expected Content [34, 53]
- Usefulness
  - I think that it is helpful to navigate Wikipedia with my expectation.
  - I think that it is useful to navigate Wikipedia with my expectation.
- Ease of Use
  - I think that it is easy to navigate Wikipedia with my expectation.
  - I think that it is free of effort to navigate Wikipedia with my expectation.
  - Problem Solving
  - I think that I like to navigate Wikipedia to solve problems with my expectation.
  - I think that I am interested in navigating Wikipedia to solve problems with my expectation.

Hyperlinked Serendipitous Content [8, 34]
- Usefulness
  - I think that it is useful to navigate Wikipedia without any expectation.
  - I think that it is helpful to navigate Wikipedia without any expectation.
  - Ease of Use
  - I think that it is easy to navigate Wikipedia without any expectation.
  - I think that it is free of effort to navigate Wikipedia without any expectation.
- Problem Exploration
  - I think that I like to navigate Wikipedia to solve problems without any expectation.
  - I think that I am interested in navigating Wikipedia to solve problems without any expectation.

Lock in Future User [54-56]
- I will continue to use Wikipedia in the future.
- In the future, I will still need to use Wikipedia to support my work or task.
- My need for Wikipedia will be the same in the future.

Prolonged the Stay Time [54-57]
- I think I have ever experienced flow in learning while using Wikipedia.
- In general, I have experienced 'flow' frequently while learning something on Wikipedia.
- Most of the time when I learn something using Wikipedia, I feel that I am in the flow.

Fraction Time
- Wikipedia helps me to find information efficiently.
- I can use a brief period to find information on Wikipedia.
- I choose Wikipedia to find information in the brief amount of time that I have.

Locus of Control [48, 58]
- I think that most problems will solve themselves with the help of Wikipedia.
- I think that some people are just born lucky in finding information on Wikipedia.
- I think that I am in control of any information that I get from Wikipedia.
- I think that no matter what I do in navigating Wikipedia if I am going to get the information, I will get it.
- I think that if I try hard to find information on Wikipedia, I can find it.
- I think that the information I get depends on how well I try to navigate Wikipedia.

I think that what I do on Wikipedia is not going to affect my search results on Wikipedia.