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AN EMPIRICAL STUDY OF SMARTPHONE GAME PERFORMANCE UTILIZING EVOLUTIONARY BIOLOGY PERSPECTIVE

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ABSTRACT

Humans have evolved to walk upright since a million years ago. However, as an industrial society entered, seating and working hours became abnormally high only a few decades ago. This has caused the human body to be badly affected. According to the preceding medical studies, the environment of sitting and working for a long time negatively affected adult diseases. In modern society, people are doing long-again tasks such as sitting in one place or standing up. This has many side effects on the human body. This is because humans have evolved in a moving direction. Reflecting this background, the study adds evolutionary biological perspective to think about working in a walking environment as well as standing desk working environment. It also expected expansion of the mobile office environment where smartphones, a type of smart work, are used directly in the field. To do so, it is going to carry out an experiment that does work with Smartphones. The study could help build and establish a mobile office environment, a type of smart work. In addition, a working environment for walking around as well as using smartphones could be developed. Furthermore, the work environment and the study environment of students could change.

Keywords : *Evolutionary Biology, Mobile Office, Medical Study, Smart Work, Smartphone*

1. INTRODUCTION

1.1 The need for research

1.1.1 Research background

(1) Diffusion of the Internet

Entering the age of knowledge and information, we can not even imagine a world without Internet. With the introduction of smart devices, a wide range of internet access has become available. In 2017, 84.8 percent of Korean Internet users accessed the Internet using smartphones, according to the Global market Research institute. Also, the tablet usage rate in Korea has increased from 22% last year to 22.9% this year. That number amounts to 11.17 million. Korea's Internet use rate stood at 87.8% in 2017, compared to 87% in 2016. The figure stands at 49.9 million. Akami, a content transmission platform, analyzed that the ultra Broadband Convergence Network(uBCN), which was established by the Korea Communications commission since 2009, helped speed up wired Internet speed[1].

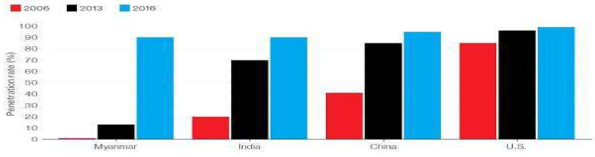

Figure 1. Smartphone Usage Trend By Country (Myanmar, India, China, USA)

The introduction of smart devices is taking place not only in Korea but also globally. Recently, the use of smartphone in Myanmar has increased dramatically. As the price of smartphones becomes cheaper, they move from existing feature phones to smartphones that allow people to use the Internet more freely. As Myanmar's government implemented economic reforms, related businesses such as mobile apps and shopping malls grew rapidly [2].

Computer and Internet technologies are used in various fields from education to home appliance. Technologies using the Internet are already closely connected to our lives and are changing our lives. For example, applications on smart phones offer more and more convenient travel opportunities. Apps that tell the exact time of arrival of subways and city buses are now being deployed to check out the remaining seats. The map app predicts the fastest route to the destination and how long it takes. A typical example of big data being used in policy development is the city government's late-night buses. The Seoul Metropolitan Government has recently built an optimal night bus route and a

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new station. This is based on the Seoul Metropolitan Government's link between floating population data and the call base station location big data [3].

The use of the Internet is increasing even in the financial sector. According to the Bank of Korea's report, 'Current status of domestic Internet banking services in the third quarter of 2017', the total number of customers registered in Internet banking by 18 financial institutions in late September 2004 was 322.46 million. The figure is a 4.3 percent increase from the previous quarter, with the growth rate of 'actual customers' with a record of 8.8 percent over the past year. The actual rate of smart phone banking subscribers, which stood at 38.9 percent in 2013, rose to 66.2 percent in the third quarter of this year [4].

Figure 2. Internet Banking Service Usage Status in the Third Quarter of 2017

(2) The introduction of smart work

This environment starts to come up with the concept of smart work. Smart work refers to a system that allows people to work anywhere, anytime, without restrictions on time and place. With the widespread use of smartphones, more and more people are using smartphones. A number of forms of smart work were introduced, including mobile office where you can use your smartphone in the field when you are in a sales or AS job, smart offices that perform teleworking and video conferencing to reduce costs and prevent waste of meeting time for business trips, woman's work and childcare and telecommuting, to reduce corporate operating costs. By building world-class wireless network infrastructure, such as broadband network deployment, GIGA internet, and WiBro, and expanding smartphone, tablet, and cloud computing services, Smart work, where you can have a working environment like an office anywhere, is becoming more social and empathetic [5].

Smart work has been introduced and spread faster than in Korea overseas. In the United States, there have been 14 smart work centers in the vicinity of the capital, Washington, since 1992. In Japan, the government announced 'the way we work' in 2017. According to the results of the General Affairs Survey, 13 out of 22 ministries of the central government introduced telework. The Japanese government is promoting telework in the metropolitan area ahead of the 2020 Tokyo Olympic and Paralympics. In the Netherlands, 49 percent of all businesses were already operated by remote workers in 2007. Companies with large employment had a high percentage of remote workers and 91% of those with 500 and more employees worked remotely. 99 smart work centers, complete with teleworking, welfare facilities and video conference financing, were jointly established and operated by a public private company [6-7].

(3)Problems of working environment from evolutionary biological point of view

In most countries, work hours are over 6 hours. Data released by the OECD in 2016 showed that many countries except Germany and only a few countries worked an average of 6 hours a day in France, the United States, and Britain. It has been reported that Korea works an average of 8 hours a day. The problem with this is that most of the work hours are spent sitting down and working [8].

Kilpatrick Michelle and 4 others argue that reducing the amount of time spent sitting down is beneficial to mental health. It turned out that workers who worked more than 6 hours had a common problem. Studies show that women are especially struggling. Neville Owen, Genevieve N Healy and 2 others warn of the danger of sitting long. They say that even if they meet physical activity guidelines for long periods of time, they can damage their metabolism. They have demonstrated a harmful link between watching TV and health. They said that sitting time including watching TV and driving, increases the risk of premature death. J. Henson, T. Yates and 8 others studied the link between sedentary and physical activities. This study describes the complex health indicators of Type 2 diabetes in the experimental group and the link to sitting time [9-11].

In fact, human beings have evolved from millions of years on their feet toward the upright. However, as we enter an industrial society, the human body

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has been adversely affected by the abnormally increased time spent sitting and working just a few decades ago. Looking at preceding medical studies, it has been revealed that the long-term working environment has significantly affected the cause of adult diseases we have known. On the other hand, studies on the correlation between physical activity and brain function are coming out one after another. For example, if the body is actively moving, it can prevent and improve cognitive skills due to aging, and children who exercise have better grades. For this reason, the spread and promotion of a European working environment continues. In particular, Northern Europe is creating an environment in which it can work standing legally[12-13].

Standing desk is a desk designed to stand or sit high and write or read. Although recently introduced to offices primarily through public institutions, it was used mostly by the rich from the 18th and 19th centuries. The advantages of a standing desk are still disputed. There are claims that it will be beneficial to health, but nothing has been clearly demonstrated. Some claim it was exaggerated for commercial use. Table 3 is about prior studies on the health effects of sitting and standing [14].

Table 1. A Prior Study On The Health Of Walking And Standing

Benefis	A prior study
Calorie consumption	· A 2013 study showed that the heart beats faster, on average 10 times a minute, than it did sitting on a standing desk. · This is about 50 more calories per hour ·A 2012 study showed that people using sitting and standing desks consumed a further 20.4 calories per hour. Assuming you stand three hours a day on average, 5 days a week, it is equivalent to consuming 206 calories to 750 calories a week
Varicose Veins	· Denmark's 2005 study involved close to 10,000 adult workers over 12 years. According to the study, those who worked most were 44% less likely to receive hospital treatment for varicose veins. According to the respondents, there is a higher probability of developing varicose veins over the years they were not sitting · In a small 3 year study of women in Denmark, a small group of women found a risk of varicose veins 163% higher than the group they sat in
Metabolic Risk	· According to a 2008 study, the length of time spent sitting up without a break is associated with metabolic risk. It has been linked to diabetes and heart disease. For most of the people who sit in a seat all day, the risk of their heart attacks is like smoking. Long term retention associated with glucose control problems in the meridians and reduced the production of lipid protein Lipase, both leading to increased risk of heart disease.
Pregnancy and Birthweight	· A 1995 study on pregnant women found that standing at work for a long time affects the rate of births. Babies born to women who spent more than five hours per hours were younger than children who worked less than two hous per hour. Babies born to women who walked more than 5 hours a day had a significantly lower birth rate than women who walked less than two hours per day. However, women who reported walking for more than two hours but less than five hours a day had higher weight children.
Mortality	· A 2009 study of more than 17000 Canadians concluded that doctors should reduce the time spent sitting. · Another US study concluded that sitting for less than 3 hours a day could increase the life expectancy at birth by about 2 years. · According to a 2010 study, sitting hours independently of the level of physical activity are associated with total mortality · In a 2010 paper, he found 43 articles that related sitting times, health risks, or death rates, and found five articles with opposite opinions.
Other Benefits	· Standing desks can help be more creative. This is because they change their location during working hours to prevent discomfort. Writers such as Charles Dickens, Virginia Woolf, Ernest Hemingway, and Lewis Carroll have all used standing desks for years.

Although arguments remain over the advantages of standing and sitting down, people who actually use standing desks speak positively. People who use standing desks have more energy and feel

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healthier than people who work sitting down. They also say that standing up makes the spine stand up in a row, which reduces the stress on the back, which makes your neck hurt less. One of the standing desk users said he felt like he was doing a multi-tasks, and that even sitting down and working looked like a lazy person[15].

1.1.2. Purpose of study

The primitive man descended from a tree and walked upright. Human evolution is believed to have resulted from upright walking. Recent studies also suggest that humans evolved to drive upright rather than upright walking.In any case, the fact that mankind has evolved in the direction of motion remains unchanged. So, like modern society, sitting or standing in one place for a long time without any movement has many side effects on the human body. On the other hand, using the prevailing Internet environment, the latest work patterns are slowly shifting to smart work. Work from office to home and on the road using smart devices. Reflecting this background, in this study, we began to think about the traditional standing desk working environment, moving one step further from an evolutionary biological perspective. It also plans to conduct an experiment to handle work with smart phones, expecting to expand the mobile office environment in which smart phones are used directly in the field.

In this study, we intend to observe the impact of a work environment on performance, reflecting the human characteristics demonstrated by evolutionary biology. The work environment is divided into walking and working environment and sitting environment. Further, it is going to derive factors that affect work performance through literature review, and collect data through experiments and surveys to establish empirical relationships. Specific research objectives are as follows.

First, analyze if the work environment affects performance.

Second, derive the leading factors that affect the performance of the task.

Third, the impact of the work environment on the leading factors affecting workperformance is analyzed.

Fourth, the relationship between the factors that affect the performance of the task is analyzed.

1.2 Method and Scope of research

1.2.1. Research method

In this study, the Literature Review Act was applied to achieve the research objectives. A literature study considered the meaning of movement in evolutionary biology, computer skills. The study model was also developed by considering the impact of immersion and happiness on work performance.

An experiment using a smartphone was conducted to verify the study model and hypothesis. The results of the experiment are used as data to indicate task performance. Then, the questionnaire was completed through the literature study. Data collected from the survey were interpreted through statistical analysis.

1.2.2. Research scope

The content ranges established in this study include the meaning of motion in evolutionary biology, and theoretical considerations of computer literacy factors. The scope of the target is selected by using the convenient sampling method for students of the department of information systems at Hanyang University. Time horizon is to be studied from October to November 2017. Confirmation studies of concepts and relationships through the preparation of questionnaires were conducted in October, and quantitative data collection through surveys and experiments was carried out in November.

1.3 Definition of Terms

1.3.1. Working environment

Existing studies on the work environment have motivated and motivated organizational members to maximize their performance based on the findings that their effectiveness may vary depending on how they are assigned to them. In this thesis the work environment is divided into two situations. We divide the experiment into walking and sitting in front of the desk[16].

1.3.2.Immersion

Immersion refers to a subjective experience that occurs when performing a given task or activity in a situation where the level of skill is consistent with the degree of initiative of a given task or activity. Those who have experienced this kind of immersion feel total satisfaction beyond being funny. Since the launch of the Internet, it has expanded its immersion theory for computer users in the field of psychology. Hoffman & Novak reported that immersion in an online environment results from the optimal experience that Internet users feel when performing online activities. Based on this, the immersion in online games refers to a state in which users feel the optimal experience of the overall sense while playing online games.

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Importation in this thesis implies game immersion and includes confidence, satisfaction, and control of game[17-18].

1.3.3. A feeling of happiness

Conventional wisdom has been that happiness is not the subject of social science research. This was because the concept of happiness reflected values. In order to solve the problem of subjective nature of happiness, happiness has been studied through objective indicators, a typical example is quality of life. The concept that was created to overcome subjective traits of happiness is called subjective well-being. The subjective sense of happiness follows a hedonistic point of view. And subjective happiness refers to subjective psychology of one's own life. This thesis defines subjective happiness as happiness, and indicates frequency and degree of emotion, negative feeling such as depression or anxiety, and satisfaction of life[19].

1.3.4. Business performance

While performance usually refers to how well an individual performs a given task, an exact definition of the concept still does not exist. Nevertheless, this is an important criterion for the organization's performance and success. From a psychological standpoint, Campbell (1990) describes performance as a personal variable, ' what one person does '. This differs from other variables such as organizational and national achievements. Although we can use the workload, hours of work, and quality of work as an indicator, this paper defines the time taken to succeed in the game as performance [20].

1.3.5. Computer literacy

Computer literacy is the knowledge or skill required in an information society to use computers. They generally indicate basic knowledge of computers, hardware and software, the ability to use various software, and the ability to produce simple programs. This level of knowledge or skill indicates the degree to which a computer can be used to perform the tasks required in one's daily life, and the indicator is the computer's self-efficiency [21]. Therefore, in this thesis computer utilization and computer self-efficacy (CSE) are defined as the same term.

1.4. Composition of Research

The study consists of five chapters. Chapter 1, Introduction, describes the research background. It explains that the concept of smart work introduced by the introduction of smart phones and the environment in which we sit too long is harmful to our body from an evolutionary biological perspective. It also describes the purpose of the study, the method of study, and the scope.

In Chapter 2, theoretical considerations take place. Review the literature and prior studies related to the origin of human upright walking and upright theory in evolutionary biology. Relevant studies are also reviewed for computer skills.

Chapter 3 describes the research design. Talk about how the research model was constructed. Based on the research model a hypothesis is established, questionnaire is created with the survey tool, and the method of analysis is briefly mentioned.

Chapter 4 statistically analyzes data collected according to experiments and surveys. Afterwards, discuss the results and verify the study hypothesis.

Finally, Chapter 5 discusses the summary, discussion and implications of the study and the implications and limitations of the study.

If you look at the details of the foregoing, you can see Fig 5

2. THEORETICAL CONSIDERATIONS

2.1. Evolutionary Biology and Walking

2.1.1. Origin of erect gait of mankind

Dawkins based his theory on the theory of gender selection. Our ancestors, like other apes, walked on all fours when they were not on top of a tree. And sometimes, like the apes and monkeys, walked on both feet. Whether picking fruit from low branches or crossing a river, he would stand two feet for one reason or another. the heart of his argument is that two feet standing have become popular at some point. This is what happens when you imagine a series of events that have happened to the ancestors. An ape in worship or superior status, such as most trends, may one day perform a unique feat of keeping his feet on his feet. It would have given him a sexual attraction and social status. And other apes imitated his own unique habits. Women want to join the trend because accepting a new walk has been admired in the popular social group. For this reason, she preferred to mate with a man who skillfully achieved a new gait. And the mutation, the ability to ‘ walk’, probably has evolutionary meaning as a genetic component. This is central to Richard Dawkins ' logic. And then his logic follows the standard general-sensitive theory. Through the mother's choice of a mate, there is a higher chance that she will have a child who has inherited the popular two-foot-walking technology. They may also have inherited

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a preference for their mother's 'two-foot-walking man'.

This is the core of Fisher, RA, theory of runaway selection. The theory, also called Fischerian runaway, was argued by Ronald Aylmer Fisher, a British agronologist and statisticist. The dual choice shown in the previous example is to choose men with certain abilities, women who admire and follow them. The point of the theory is that sexual selection runs in a random direction and produces a capricious and ingenious evolution that creates a leap of imagination. That is why evolution could have gone in the opposite direction, and indeed it has. These random, unpredictable evolutionary derailments can explain why our ancestors suddenly evolved in the direction of two-foot-walking, while other ape groups may not[22-23].

2.1.2 The upright running of mankind

The primitive man had to avoid being eaten by predators before he could catch another animal. There was this strong, life-saving bond between primitive hunters. Hunting was the result of close cooperation. This process is believed to have strengthened the propensity for sharing human food.

This process is believed to have strengthened the propensity for sharing human food. The evolution of mankind has been attributed to upright walking. Beginning upright walking, he was free from his hands. Primitive man made tools with free hands. Tools made humans possible, and the human brain developed through the process of tool making. However, in recent years, humans have evolved to drive upright, not upright. Human beings are much slower than four-legged creatures, but there is a claim that they beat almost all other animals in endurance. In fact, there was a case in which a person crossed the finish line by passing a horse in 2004 in the ' Men vs. Horse 's Marathon ' competition in England.

Running should have been very lucrative for humans because they evolved to run, but it didn't really help them escape predators. But it was enough to turn mankind into a hunter. The hunter's run was not a short distance, but a long run.

The Tarahumara Indians of northern Mexico follow for two days to hunt deer. Their target deer often fall down with their hooves completely worn out. In addition, the BBC captured the footage of Kalahari Bushman succeeding in hunting after eight hours of pursuit.

Researchers say the growth of the human brain is closely linked to eating meat. If we hadn't eaten meat, we would never have evolved into humans. The raw human brain expanded as if a dry sponge absorbs water with the protein of meat obtained by hunting. The brains of primitive humans grew until they were seven times as large as those of similar mammals. Its performance has also improved. The share of the brain in weight is similar to that of chimpanzees and humans. However, chimpanzee brains contain 9 percent of the body's energy. However, 20 percent of the energy is injected into the human brain. Running and hunting made mankind a human being. Human DNA carries running and hunting. This is why mankind is so enthusiastic about soccer, a sport that combines the practice of hunting by running

A key proof to support the claim that humans evolved to run is feet. Human feet are smaller, lighter and more resilient than primates. A person with large feet like a chimpanzee is less likely to run than an average person. The more important thing that distinguishes human feet from the feet of primates, including chimpanzees, is life at the bottom and Achilles ' heel. Human feet are more scaled-out than other primates, and their Achilles ' tendon is much longer, thicker, and stronger than other primates. Footstep and Achilles tendon help the motion to run. OrstraloPithesin shows that there was no movement on the ground. Also, Dennis Bramble, a biology professor at the University of Utah, and Daniel Liberman, a professor of archivism at Harvard University, have seen a fine print on the heel of the Achilles ' tendon and therefore their Achilles ' tendon, so they would not develop [24].

2.1.3. The effect of movement on the brain

There is little objection to sustained, regular exercise. A recent study found that walking more than 4,000 steps a day improves brain health for those over 60 years old. Studies show that even a single exercise is effective. Researchers at New York University in the U.S. said that a combined analysis of existing studies clearly showed that about an hour of exercise improves the overall brain function. Researchers at the University of McMaster in Canada have published a paper saying it will help in just 20 minutes. According to the medical journal Medical News Today, Professor Matthews of the University of Western Canada has measured the minimum exercise time needed to activate brain function and found that even after 10 minutes of exercise, there is a clear effect

The research team asked participants to sit in a chair, read a magazine for 10 minutes, and do exercises corresponding to the medium or high

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intensity of their physical strength on an indoor bike for 10 minutes. Then, it measured changes in brain function through the so-called 'reverse rapid eye movement suppression (antisaccadetask : AST) test.'. As a result, those who exercised increased their skills immediately. The response was more accurate and the response time was a quarter of a second shorter than the non-motivated group. According to the research team, this may seem like a very small difference, but it is a 14 percent improvement in cognitive ability, which is quite significant in the effectiveness of the 10-minute exercise.

The research team should further study exactly how these effects occur. However, they said exercise is believed to stimulate the frontal lobes of the brain.

Professor Heath said, " The study results show that people who are in the early stage of cognitive decline and people who are unable to continue to exercise for a long time or even 10 minutes can do aerobic activities such as biking or walking fast. " He also encourages students to exercise even a little first if they need cognitive skills such as tests and interviews. Our brains are bound to show appreciation if we move our bodies [12].

2.2. Computer Literacy

Computer literacy refers to the knowledge and skills needed to use computers in an information society, and it uses these skills to perform the tasks required in one's real life. In this paper, an indication of computer skills was measured using computer self-efficiency.

2.2.1. Self-Efficacy, SE

Self-efficacy is the first introduction by American psychologist Albert Bandura in his book Social Learning Theory. Bandura saw humans as having a reflective ability to control emotions, thoughts, and behavior, and felt self-effective as one of the most powerful self-regulation processes. Self-efficacy is a personal belief that you can do something well. Factors affecting self-efficacy are mastery experiences, vicarious experiences, vicarious experiences and somatic and emotional states.

Achievement means practical achievement experience and is the most influential of the four factors. Success forms a firm belief in self-efficacy. If you experience failure before your sense of self-efficacy is established, your sense of self-efficacy becomes low. The recovery of self-efficacy comes from the experience of overcoming obstacles through perseverance. By enduring difficult times, we are stronger from adversity.

Proxy experience refers to information obtained from observation learning. In other words, information obtained from the performance of the person around you. Proxy experience affects the learning of observers through a curriculum of principles, memory, production, and motivation. Although proxy experience is weaker than actual success, the success of a model with similar characteristics partly affects self-efficacy.

Linguistic persuasion is a way of giving a person the belief that he or she has the ability to achieve the task to be accomplished. It has less impact on self-efficacy than performance or proxy experience. However, it is effective to persuade the moderator to continue his task of stopping. Linguistic persuasion may differ depending on the persuasive social status, influence on the recipient, and credibility. Unrealizable persuasion can reduce the reliability of the persuasion man and the trainee's self-efficacy.

People also partly rely on physical and emotional states to judge their abilities. People interpret stress response and tension as weak signs of weak performance. In activities including physical strength and physical strength, people judge fatigue, pain, and suffering as signs of physical weakness. People also influence people's judgments about their personal effects. A positive atmosphere improves the self-aware and reduces the feeling of dejection [3-4].

2.2.2. Computer Self-Efficacy, CSE

Computer self-efficacy is based on Bandura's established sense of self-efficacy. Self-effectiveness is not just the ability to perform specific tasks based on past performance or experience. Rather, it is a concept that can have an important effect on the intent of action toward the future.

The CSE, which was introduced and defined in the field of information systems, was considered to be an important antecedent to the performance or performance of computer use. CSE stands for subjective belief or confidence in an individual's own ability, which is differentiated from the ability to use computers objectively.

CSE is also a self-respecting assessment of its ability to use computers. The CSE is concerned with control of the individual's perception of the availability of knowledge, resources and opportunities required to act. Control is an external control that is relevant to the environment, such as the knowledge and resources needed to use the information system and the perception of the

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availability of the opportunities, and an internal control that can relate to its own knowledge. CSE is one of the typical internal controls.

The operationalization of the CSE can be done at a specific task level and at a typical level. In the case of the former, it is the sense of efficacy that an individual will perceive when performing certain computer-related tasks in a typical computing environment. Examples include specific information technology areas such as word processors, spreadsheets, databases, and various information systems operated by companies. The latter, on the other hand, is a level of efficacy determined by the individual in various computer applications. Conceptually, CSE is a collection of several specific levels of CSE.

According to a planned behavioral theory proposed by Ajzen (1991), CSE has a direct impact on information technology usage intentions. For example, Mathieson (1991) applied the planned theory of behavior to embrace information technology to obtain a distributed description of a technology acceptance model, with Taylor and Todd (1995) having similar results.

On the other hand, the CSE has an indirect influence on intent to use as an external variable for ease of use and utility. CSE is closely related to ease of use. Because acceptance of a new information system can make it difficult or easy for an individual to use a new system with the knowledge and ability associated with a computer when he or she has no direct experience with the system. In addition, the CSE and its usefulness have a positive relationship because confidence in information technology related capabilities or knowledge can have positive thoughts about the products it will provide.

3. RESEARCH DESIGN

3.1. Research model and Hypothesis

3.1.1. Research model

This study explores the impact of an evolutionary and bio-compatible working environment on the performance of a task through the study model shown below. The independent variables were divided into two situations : a walking environment and a sitting environment.

A study model was developed based on the correlation between the level of immersion and performance of work, the relationship between computer skills and performance of computer-based tasks, and the impact of task satisfaction on performance.

In a study conducted by Kim Sang-kyu, Jung Woo-jin, Kim Ki-young and Choi Young-yoon (2010), he recognizes high satisfaction level through walking. Ha Ji-young (2011) refers to walking efficacy and refers to a hormone called cortisol. The function of the hormone is to keep muscles tense, to make the mind clearer for quick determination and behavior, and to make the sensory organs more sensitive. An experiment was designed to see if these walking effects play a significant role in the work environment.

There are also prior studies of the correlation between job inventiveness and performance. In the field of education, Kim Young-min (2011) studied

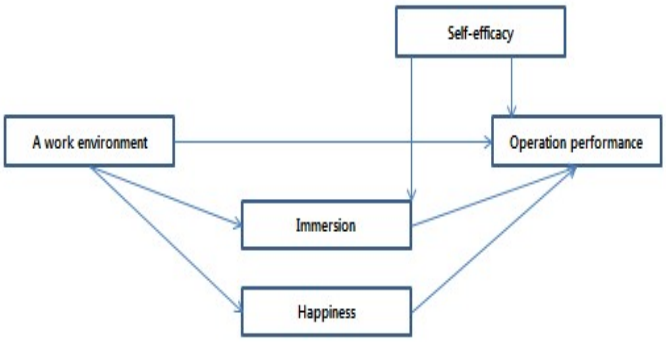

Figure 3. Research Model

the impact of learning immersion on learning outcomes. Jung Hyo-sun and Yoon Hye-hyeon (2009) found that job satisfaction had a significant impact on organizational integrity.

Kim Moon-seong and Park Seong-cheol (2011) conducted research on the impact of a sense of self-efficacy among government employees on their performance. Lim Kyu-hyuk and three others (2010) conducted a study on the influence of self-efficacy feelings on online game immersion.

A study of the literature revealed that it was possible to create a research model like Fig 6.

3.1.2. Research hypothesis

The hypotheses are finally summarized as follows :

H1 : the work environment will affect performance.
H2:Computer skills will affect performance.
H3:Computer skills will affect game immersion.
H4 : The work environment will affect game immersion.
H5 : The work environment will affect subjective happiness.
H6: Game immersion will affect performance.
H7:The subjective happiness will affect work performance.

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3.2. Experimental Design

3.2.1. Subject of study

The study selected samples using the available sampling method from the non-probability sampling method. A sample study was conducted of 80 students majoring in information systems of Hanyang University in Seongdong-gu, Seoul.

The selected participants were divided into 38 walking environments and 36 sitting environments, as shown in Table 4. The six players who did not proceed smoothly or did the survey insincerely were excluded.

Table 2. Objects Of Study

Sortation		The number of people(%)
A work environment	Walking environment	38 (51%)
	Sitting environment	36 (49%)
	Total	74 (100%)

3.2.2. Collecting data

The draft questionnaire was prepared from October 28, 2017 (Saturday) to 29, 2017.
On November 3, 2017, 31 students who took the ' Information System Design ' course were surveyed in advance.

On November 6, 2017, an application to be used for an experiment was installed on a smartphone and a short education was provided on how to play games. Then they trained their students to become familiar with the game over the course of a week.

On November 12, 2017, the questionnaire was finalized and conducted. On the 13th, a survey was conducted on the groups that played games while walking, and on the 13th, groups that played games sitting and playing games were conducted twice.

Three experiments were conducted directly by the same interviewer. Interviewers could increase the recall of questionnaires by themselves and obtain relatively accurate information because they could provide help to respondents.

3.2.3. Research tools

(1) Survey
In this study, we used computer skills as a measurement tool for collecting research data, the Oxford Happiness Questionnaire : OHQ and Flow Status Scale: FSS. Details are as follows.

1) Computer literacy

A questionnaire to measure computer literacy was consulted in a study by Byun Yoo-jin (2009). The survey will give 20 questions to measure computer self-efficiency. 9 questions on system management skills from the study of Murphy (1989) and Shin Dong-mi (1999), 7 questions on software literacy from the study of Kinzie et al(1993) and Kim Sa-im(2003), 4 questions on Internet literacy [25].

The results of the factor analysis obtained using the above tools are as Table 3.

Table 3. KMO And Bartlett About Computer Literacy

KMO (Kaiser-Meyer-Olkin)		.865
Bartlett sphericity test	Chisquare	1058.032
	degree of freedomf (df)	190
	significance probability	.000

The KMO measure indicates how well the correlation among the variables is explained by the other variables, which is generally judged to be good if above 0.7. Here it appears to be 0.865, which is considered good.

Bartlett's spherical test is a test to determine whether the use of factor analysis is appropriate. Because the degree of freedom p appears to be less than the reference value of 0.05, it can be concluded that the use of factor analysis is appropriate.

Table 4. Communality Of Computer Literacy

	initial	extraction
CSE1	1.000	.614
CSE2	1.000	.665
CSE3	1.000	.670
CSE4	1.000	.663
CSE5	1.000	.541
CSE6	1.000	.696
CSE7	1.000	.673
CSE8	1.000	.701
CSE9	1.000	.831
CSE10	1.000	.723
CSE11	1.000	.621
CSE12	1.000	.542
CSE13	1.000	.618
CSE14	1.000	.576
CSE15	1.000	.489
CSE16	1.000	.440
CSE17	1.000	.440
CSE18	1.000	.814
CSE19	1.000	.816
CSE20	1.000	.650

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Commonality represents the ratio explained by the factors extracted. Generally, it is better to exclude them from the factor analysis if they are less than 0.4. As there are no variables with low commonality, proceed as stated Table 4.

Table 5. Total Variance Explained Of Computer Literacy

Factor	initial eigenvalue		
	Total	%of variance	Cumulative %
1	9.119	45.593	45.593
2	2.185	10.927	56.521
3	1.478	7.390	63.911
4	1.301	6.503	70.413
5	.906	4.528	74.941
6	.795	3.976	78.917
7	.693	3.467	82.385
8	.628	3.140	85.525
9	.468	2.342	87.867
10	.455	2.273	90.139
11	.399	1.994	92.134
12	.326	1.630	93.763
13	.247	1.233	94.996
14	.216	1.081	96.077
15	.182	.910	96.987
16	.147	.736	97.723
17	.137	.686	98.409
18	.119	.593	99.001
19	.115	.576	99.577
20	.085	.423	100.000

Factor	Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
	Total	%of variance	Cumulative %	Total	%of variance	Cumulative %
1	9.119	45.593	45.593	4.619	23.094	23.094
2	2.185	10.927	56.521	4.568	22.841	45.935
3	1.478	7.390	63.911	3.595	17.976	63.911

The total variance described is 15 % in proportion as a result of reducing 20 variables to 3 factors. However, if you look at cumulative percentages, 63.911 percent are found. That is, three factors account for 63.911 % of the variance. In general, a cumulative explanation of more than 60 % indicates that factors have a high level of reasoning power.

Table 6. Component Matrix Rotated Of Computer Literacy

	Factor		
	1	2	3
CSE11	.752	.100	.215
CSE13	.743	.206	.152
CSE20	.725	.351	-.024
CSE14	.683	.249	.217
CSE12	.668	.297	.085
CSE3	.637	.294	.421
CSE2	.588	.339	.453
CSE5	.585	.059	.442
CSE19	.260	.865	.018
CSE9	.290	.857	.110
CSE18	.312	.836	.135
CSE10	.298	.765	.224
CSE1	.160	.649	.409
CSE6	.215	.191	.783
CSE8	.222	.459	.663
CSE16	.072	.070	.655
CSE7	.222	.467	.637
CSE15	.486	.010	.503
CSE17	.153	-.405	.503
CSE4	.443	.464	.501

In Table 6, Factor 1 has characteristics of system management ability, Factor 2 has internet utilization, and Factor 3 has software skills.

2)A feeling of happiness

In this study, the 29 items presented in the Oxford Happiness scales questionnaire (Oxford Happiness Questionnaire : OHQ) were used to measure happiness. The existing OHQ is a 29 questions self-reported questionnaire. They demonstrated the validity of recruiting on this scale by using OHQ validation studies. The questionnaire, which was produced on the six step scale, was reduced to five questions. In addition, items in the negative sense were recoded and analyzed with average scores for each area, and higher scores meant higher levels of happiness.

3)Immersion

Flow State Scale (FSS) used in Lee Jun-seok's study to measure the degree of immersion was used. He was inspired by Kim Hyang-hee's 2005 paper, which showed that his overall credibility was. 84 [26].

The results of factor analysis using FSS in this thesis are as Table 7.

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Table 7. KMO And Bartlett Test Of Engagement

KMO (Kaiser-Meyer-Olkin)		.862
Bartlett sphericity test	Chisquare	859.365
	degree of freedom (df)	190
	significance probability	.000

The KMO measure appears to be 0.862, which is considered good. Because the degree of freedom p appears to be less than the reference value of 0.05, it can be concluded that the use of factor analysis is appropriate.

Table 8. Communalities Of Engagement

	initial	extraction
FSS1	1.000	.749
FSS2	1.000	.605
FSS3	1.000	.593
FSS4	1.000	.688
FSS5	1.000	.677
FSS6	1.000	.747
FSS7	1.000	.642
FSS8	1.000	.444
FSS9	1.000	.706
FSS10	1.000	.638
FSS11	1.000	.721
FSS12	1.000	.625
FSS13	1.000	.666
FSS14	1.000	.683
FSS15	1.000	.653
FSS16	1.000	.615
FSS17	1.000	.523
FSS18	1.000	.768
FSS19	1.000	.603
FSS20	1.000	.680

As there are no variables with low commonality, proceed as shown in Table 8.

Table 9. Total Variance Explained Of Engagement

Factor	initial eigenvalue		
	Total	%of variance	Cumulative %
1	8.439	42.196	42.196
2	1.884	9.422	51.618
3	1.574	7.871	59.489
4	1.130	5.649	65.138
5	1.047	5.237	70.375
6	.887	4.434	74.809
7	.790	3.951	78.760
8	.597	2.985	81.745
9	.514	2.569	84.314
10	.486	2.429	86.742
11	.473	2.365	89.107
12	.391	1.955	92.062
13	.356	1.779	92.841
14	.319	1.593	94.433
15	.283	1.417	95.850
16	.236	1.179	97.029
17	.178	.890	97.919
18	.155	.774	98.694
19	.147	.736	99.429
20	.114	.571	100.000

Factor	Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
	Total	%of variance	Cumulative %	Total	%of variance	Cumulative %
1	8.439	42.196	42.196	5.195	25.976	25.976
2	1.884	9.422	51.618	2.866	14.328	40.304
3	1.574	7.871	59.489	2.696	13.478	53.782
4	1.130	5.649	65.138	2.271	11.357	65.138

The total variance described reduced 20 variables to four factors. The cumulative percent shows 65.138 percent. That is, the four factors account for 65.138 % of the variance. In general, a cumulative explanation of more than 60 % indicates that factors have a high level of reasoning power.

Table 10. Component Matrix Rotated Of Engagement

	Factor			
	1	2	3	4
FSS1	.833	.197	.121	.044
FSS6	.815	.209	.004	.197
FSS11	.779	.200	.218	.162
FSS4	.766	.180	.023	.263
FSS12	.675	.358	.055	.193
FSS7	.670	.010	.217	.382
FSS17	.550	.372	.265	.112
FSS2	.548	.242	.181	.462
FSS18	.204	.797	.251	.168
FSS20	.114	.769	-.258	-.098
FSS15	.355	.596	.323	.261
FSS19	.363	.570	.339	.178
FSS10	.251	.532	.154	.518
FSS5	.187	.220	.770	-.025
FSS13	.187	.001	.748	.268
FSS14	.503	-.003	.655	-.022

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FSS8	-.329	.137	.537	.170
FSS9	.169	.131	-.009	.813
FSS16	.300	-.067	.418	.587
FSS3	.458	.326	.253	.462

In Table 10, Factor 1 represents game self-confidence, Factor 2 indicates game satisfaction, Factor 3 indicates interference/distribution and Factor 4 indicates control.

(2) Game (Einstein Riddle)

The criteria for selecting a game were determined by games that did not have much touch, were solved logically, and required concentration. Android and ios are all games that operate the same way.

There are five levels. Among them, the experiment was conducted at an EASY level. We played the game 3 times tomeasure the time it was completed. The counter in the upper right corner measures the duration of the game. At the bottom right is Hint, which you can read and solve.

3.2.4. Analysis method

In this study, frequency analysis was conducted to determine general characteristics of the sample and main component analysis and reliability analysis was conducted to ensure validity and reliability of measurement tools. For the factor analysis, the varimax-rotation extracted factors with an inherent value of 1.0 or higher, and the questions with a common and factor loading of 0.4 or less were removed. The reliability verification did an internal consistency analysis by Cronbach's Alpha test. Additional analysis of the correlation between components was reviewed. T-test was conducted depending on the work environment.

4. RESULTS OF ANALYSIS

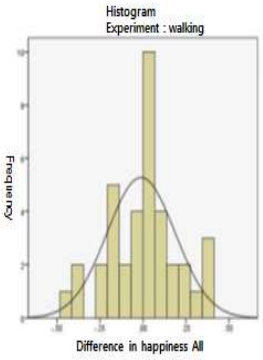
4.1. Characteristics of specimens

4.1.1. Common features of respondents

Frequency analysis was conducted on valid samples to determine the basic characteristics.

Table 11. General Characteristics Of Sample Frequency Analysis Results

			Frequency		%	valid %	acculative %	
Frequency				male	56	60.9	75.7	75.7
				Female	18	19.6	24.3	100.0
				Total	74	80.4	100.0	
value unknown at present	System value unknown at present	18	19.6					
Total		92	100.0					



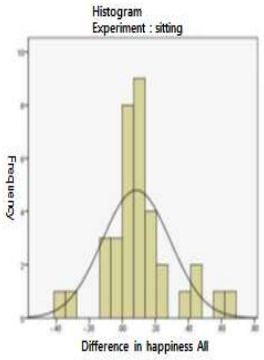
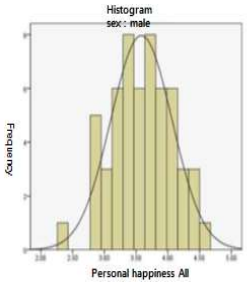


Figure 5. Distribution Graph For Age



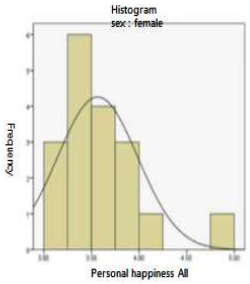


Figure 4. The Comparison Of Male And Female Happiness

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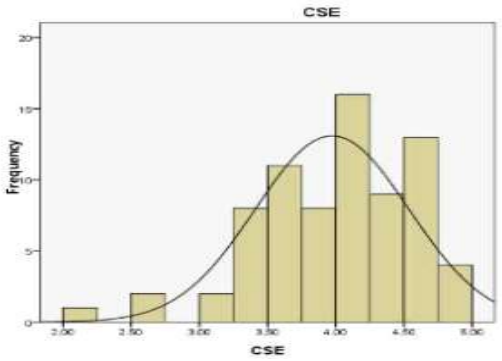

Figure 4 Graph For Computer Literacy

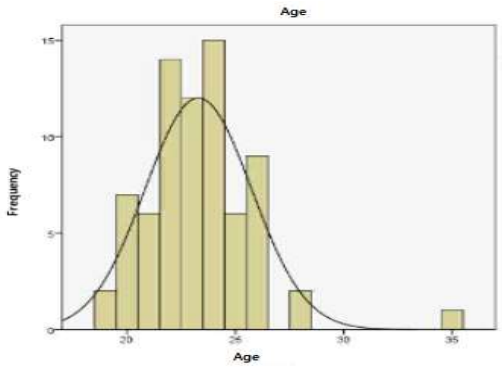

Figure 6. Walking Group And One Sitting Group Compare Happiness

Among 74 respondents, 56 (76 %) were men, 18 (24 %) were women, and higher percentage of men were men. This is probably due to the high percentage of boys due to the nature of the department.

Because of its nature as a university, the age groups are mostly in their early 20s and mid-20s. It examined the age because it was an English class for foreign students. Two students (2 percent) were the youngest, and one student (1 percent) were 35. Those aged 19 to 23 accounted for 55.4 percent. This is equivalent to 41 people.

4.1.2 Characteristics of respondents' computer literacy

Computer literacy is high in terms of its characteristics as an information system.

On the Likert 5-point scale, yes (4), very yes (5), the chosen response proportion accounts for 57 % of the total.

4.1.3. Characteristics of subjective happiness

The average happiness level for men and women is 3.5, and the average happiness level is higher than normal. The standard deviation of men's happiness is 0.48 and the variance is 0.23. The standard deviation of women is 0.42 and the variance is 0.17. So you can see that women's happiness is more evenly distributed.

The sense of happiness before and after the game varies slightly depending on the working environment. First, for a walking group, the average value is - 0.01, standard deviation 5, and the variance of 0.039 are shown to be slightly reduced about happiness. The phenomenon appears to be familiar with the cold weather and because of stress the participants were forced to perform an experiment while walking on the ground. A group of people who have been sitting down and conducting experiments produces a small difference of 0.08 and standard deviation 0.2 and 0.04 development, which appears to have been an interest in the game.

4.1.4. Characteristics of immersion

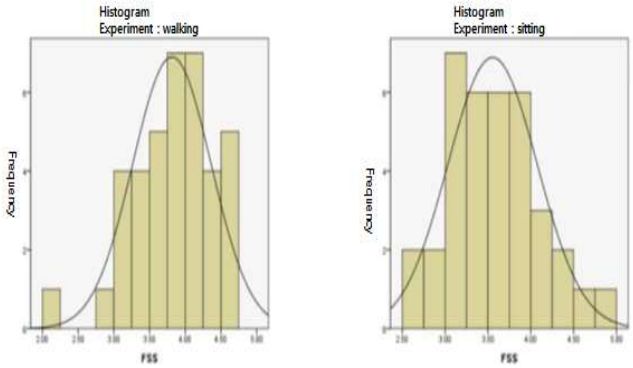

Figure 7. The Difference Between Walking Group And Sitting Group

In terms of immersion, walking groups averaged 3.81, standard deviation 0.54, and variance of 0.302. For the group that conducted the experiment, the graphs were evenly shown with an average of 3.55, a standard deviation of 0.52, and a variance of 0.27. In contrast to happiness, walking groups tend to have a higher level of immersion, which in turn demonstrates the theory that brain movements are more active when moved, according to literature.

4.2. Reliability and Validity Analysis

4.2.1. Relationship of work environment and work performance

Independent sample t test for hypothesis ' H1 : The work environment will affect performance' is conducted. A statistical method that analyzes the

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causal relationship between one independent variant and one dependent variant measured on an nominal scale. The number of groups that make up the independent variant must be two.

Table 12. Group Statistics Of Operation Performance

	Experiment Types	N	Average	Standard deviation	The standard error of the mean
T1	Walking	36	0:03:58	0:02:26	0:00:23
	Sitting	36	0:03:41	0:02:13	0:00:22
T2	Walking	36	0:02:50	0:01:22	0:00:13
	Sitting	36	0:03:13	0:01:38	0:00:16
T3	Walking	36	0:01:56	0:00:57	0:00:09
	Sitting	36	0:03:07	0:01:35	0:00:15

The experiment was conducted three times in total. Each case is defined as T1, T2 and T3.

In T1, 38 respondents were in the group that played games while walking, and the average length of time was 3 minutes and 58 seconds. The average number of respondents in the group who sat down and played games was 3 minutes 41 seconds. Compared to average values, walking and playing games negatively affect performance compared to people in the working environment where they must sit down and play games.

In T2, the average completion time for a game while walking was 2:50 seconds, and the average duration for a game sitting and playing was 3:13 seconds. Compared with average values, walking and playing games have a positive impact on performance compared to people in a work environment where people have to sit down and play games.

In T3, the average completion time for a game while walking was 1 minute 56 seconds, and the average duration for a game sitting and playing was 3 minutes 7 seconds. Compared with average values, walking and playing games have a positive impact on performance compared to people in a work environment where people have to sit down and play games.

Use significance testing to determine whether the results of a sample appear in the population. The independent sample t-validation analyzes whether the results of the study in the sample are also present in the population after calculating the t value by substituting the t formula with the results of the sample's study. To ensure proper significance testing in the independent sample t-test, the two groups ' homogeneity premises must be met. Whether two groups are extracted from the same population is a comparison of error patterns in two groups. Whether two groups are extracted from the same population is a comparison of error patterns in two groups. An error variance is a value that shows how far each score in a group deviates from the mean, indicating whether the group is homogeneous or heterogeneous. Thus, verification of the homogeneity of groups is called verification of homogeneity of error variance.

Homogeneity of groups is verified through homogeneity verification of error variance. As shown in the table above, the study hypothesis for verifying homogeneity is that the error variance in the two groups is different, and the null hypothesis is that the error variance in the two groups is equal. The significance level shall be $p < 0.05$. If the error variance in one group and the error variance in the other group are the same or similar, the two groups accept the null hypothesis and determine that it is derived from the same population. There is no problem verifying a study hypothesis if the homogeneity premise of groups is met. However, if the difference between error variances in one group and error variances in the other group is large, the study hypothesis is taken and the two groups determine that they are from different populations. If the group's homogeneity premise is not met, the values needed to verify the study hypothesis are unknown and only the estimated values can be calculated.

To verify homogeneity of error variance, the results of verification of equal variances in Levene in the table above are determined. Levene's homogeneity verification of error variance values is done with an F value and a significance probability value. The significance probability value, if less than 0.05, accepts a study hypothesis to conclude that the populations from which the two groups were extracted differ. However, if the significance probability is greater than 0.05 for the researcher, accept the null hypothesis and conclude that the populations from which the two groups were extracted are equal.

The results of homogeneity verification of Levene error variance are important in validating t study hypotheses. When performing the independent sample t-validation, two values are presented, ' Assume equal variances ' and ' Do not assume equal variances ', as shown in the table above. Note the values given in ' Assume equal variances ' for equal populations, and interpret the values given in ' Do not assume equal variances ' for different populations.

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Table 13. Independent Sample Test Results of Operation performance

		p value	t	freedom	p value (Both sides)
T1	Equal variances assumed	.972	.516	72	.607
	Equal variances not assumed		.517	71.906	.606
T2	Equal variances assumed	.349	-1.078	72	.284
	Equal variances not assumed		-1.073	68.189	.287
T3	Equal variances assumed	.012	-3.892	72	.000
	Equal variances not assumed		-3.843	56.941	.000

When judging from the results of the homogeneity of the error variance from T1, the values presented in the section ' Assuming equal variances ' since the significance probability of the two groups is equal to 0.972. Looking at this, the mean difference between the two groups is 16 seconds, the t value is 0.516, the degree of freedom 72, and p value (both sides) is 0.607. The interpretation of these results concludes that The study's hypothesis that the work environment influences the duration of the game shows that the t value is 0.516, the degree of freedom is 72, and p value is greater than 0.05.

For T2 the results of a homogeneity test of error variance from Levene indicate the values presented in the section ' Assuming equal variances ' since the probability of significance of the two groups is identical at 0.349. Looking at this, the mean difference between the two groups is 21 seconds, the t value is – 1.078, the degree of freedom 72, and the probability of significance (both sides) is 0.284. The interpretation of these results concludes that the study's hypothesis that the work environment affects the duration of the game shows that the t value is - 1.073, the degree of freedom is 72, and the p value is greater than 0.05.

In T3, as a result of the homogeneity verification of error variance by Levene, the analysis of the ' assume equal variances ' is presented in the section ' because the significance probability of the two groups is not homogeneous at 0.012. Looking at this, the mean difference between the two groups is 1 minute 10 seconds, the t value is – 3.843, 56.941 freedom, and the significance (both sides) is 0.000. The interpretation of these results concludes that

The study's hypothesis that the work environment affects the duration of the game shows that the t value is – 3.843, the freedom is 56.941, and the significance value of the game is less than 0.05. The average amount of time spent playing games while walking is relatively fast at 1 minute and 56 seconds, and the time spent sitting down and playing games is relatively slow in 3 minutes and 7 seconds.

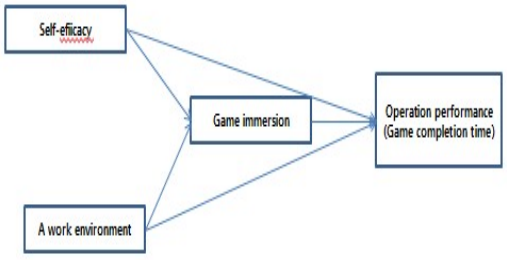

Figure 8. Aisle Model

4.2.2. Relationship between computer literacy and work performance

corridor model was created and analyzed to confirm Hypothesis 'H2:Computer skills will affect performance' and 'H3:Computer skills will affect game immersion'

The regression analysis shows the correlation coefficient in Table 16.

Table 14. The Correlation Of Computer Literacy, Game Engagement, Operation Performance

		T1	CSE	FSS
pearson correlation	T1	1.000	.281	.310
	CSE	.281	1.000	.469
	FSS	.310	.469	1.000
significance probability	T1		.043	.029
	CSE	.043		.001
	FSS	.029	.001	
N	T1	38	38	38
	CSE	38	38	38
	FSS	38	38	38

According to the correlation coefficient, the higher the computer skills, the slower the task performance, and the more absorbed the task will be. And it turns out that the higher the computer skills, the higher the immersion level. To determine if the results of this sample are still

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present in the population, conduct a significance testing.

Table 15. Significance Test Of Computer Literacy, Game Engagement, Operation Performance (Walking)

model	R	R square	R square corrected	standard error	statistics changes				
					R square changes	F changes	df1	df2	significance proportionality F changes
1	.346	120	.070	0:02:21	.120	2.383	2	35	107

In a walking group, p value is 0.107 and therefore the study hypothesis is rejected.

Table 16. Significance Test Of Computer Literacy, Game Engagement, Operation Performance (Sitting)

model	R	R square	R square corrected	standard error	statistics changes				
					R square changes	F changes	df1	df2	significance proportionality F changes
1	.265	.070	.014	0:02:12	.070	1.251	2	33	.299

Similarly, p value in the seated group is 0.299 and the study hypothesis is rejected. Thus, the hypothesis 'H2:Computer skills' will affect performance. It has been rejected and hypothesis ' H3 : Computer literacy ' will affect game immersion.' accepts Computer literacy has a positive effect on immersion.

4.2.3. Relationship between work environment and Immersion

An independent sample t test was carried out on the hypothesis ' H4 : work environment will have an impact on immersion '.

Table 17. Group Statistics Of Engagement

	Test type	N	average	standard deviation	standard error
FSS	walking	38	3.8132	.54942	.08913
	sitting	36	3.5538	.52165	.08694

The average number of respondents in the group who played games while walking was 3.813. The group that sat down and played games had 36 respondents and average immersion was 3.5538. Compared with average values, walking and playing games seem to have a positive effect on immersion when compared to people sitting and playing games. Use significance testing to determine if the results of this sample are also present in the population.

Table 18. Independent Sample Test Of Engagement

		t	freedom	p value	average difference
FSS	equivalence assumed	2.081	72	.041	.25945
	equivalence not assumed	2.084	71.999	.041	.25945

When judging from the results of Levene's homogeneity of error variance, the values presented are interpreted because p value of the two groups is homogeneous at 0.842 in the ' assumed equal variances ' section. Looking at this, the mean difference between the two groups is 0.25945, the t value is 2.081, the degree of freedom 72, and the p value (both sides) is 0.041. The interpretation of these results concludes that

According to the result of the verification of the research hypothesis, 'there is a difference between being immersed in the game depending on the working environment', the value of t is 2.081, the degree of freedom is 72, and the p value is less than 0.05. The average immersion of people who play games while walking is relatively high at 3.8132, and players who play games sitting and playing the game at a relatively low level of 3.5538.

4.2.4. Relationship between work environment and happiness

An independent sample t test was carried out on the hypothesis ' H5 : work environment will have an impact on happiness '. First, if you look at the results from walking environment,

Table 19. Correlative factor of happiness in walking environment

		N	standard deviation	significance probability
response 1	happiness 1 &happiness 2	38	.903	.000

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At both points, the correlation coefficient between the scores is necessary to verify that the response sample is appropriate by sample method. The study hypothesis is that the dependent sample is appropriate and null hypothesis is that a dependent sample is not appropriate. If the correlation coefficient has a p value of less than 0.05, you can accept the study hypothesis and determine that the dependent sample is appropriate. On the other hand, if the value of the p value is greater than 0.05, the dependent sample is not considered appropriate. In this case, accept the study hypothesis because the correlation coefficient is 0.903, and the p value is $p < 0.05$. This means that the dependent sample was adequate.

Table 20. Response Sample Statistics On The Resilience Of The Walking Environment

		average	N	standard deviation	standard error
response 1	happiness 1	3.8101	38	.51814	.08405
	happiness 2	3.7838	38	.54102	.08776

In order to verify the t study hypothesis, the mean value of the two groups presented is checked. Because it is a dependent sample, the respondent at Point 1 and the respondent at Point 2 are the same person. At Point 1, 38 people measured happiness before the game, and the average of their subjective happiness was 3.8101. The number of people who played the game at Point 2 was also 38, when their subjective sense of happiness was 3.7838. Judging only by the average value, walking and playing games can negatively affect their happiness. To determine if the results of this sample are still present in the population, perform a significance testing.

Table 21. Verification Of The Response Sample For Difference In Walking Environment

		average	t	freedom	p value(Both)
respondence 1	happiness 1-happiness 2	.02632	.691	37	.494

In order to verify the t study hypothesis, the mean value of the two groups presented is checked. Because it is a dependent sample, the respondent at Point 1 and the respondent at Point 2 are the same person. At point 1, 38 people measured happiness before playing the game, and the average of the subjective feelings of happiness they feel is 3.8101. The number of people who played the game at Point 2 was also 38, when their subjective sense of happiness was 3.7838. Judging only by the average value, walking and playing games can negatively affect their happiness. To determine if the results of this sample are still present in the population, perform a significance testing.

The results from the verification of the research hypothesis 'The difference in happiness is not in walking' as shown in the table above is that the difference in the mean value is 0.2632, and the value of t is 0.691,

The data of the next group sitting and performing the experiment are as follows.

Table 22. Correspondence Of Response Samples To Happiness In A Sitting Environment

		N	correlation	significance proportionality
respondence 1	happiness 1 & happiness 2	36	.880	.000

If you sit down and experiment, accept a study hypothesis because the correlation coefficient is 0.880 and the p value is $p < 0.05$. In other words, it is concluded that the dependent sample was appropriate.

Table 23. Response Sample Statistic For The Happiness In A Sitting Environment

		average	N	standard deviation	standard error
respondence 1	happiness 1	3.5423	36	.50271	.08378
	happiness 2	3.6304	36	.46648	.07775

At Point 1, 36 people measured happiness before the game, and the average of their subjective happiness was 3.5423. The number of people who played the game at Point 2 was also 36, when their subjective sense of happiness was 3.6304. Judging only by the average value, it appears that playing games while sitting down has a positive effect on their happiness. To determine if the results of this sample are still present in the population, perform a significance testing.

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Table 24. Sample Testing Of Response Samples For Pre Game Happiness Under Sitting Conditions

		average	t	freedom	significance proportionality
responden ce 1	happine ss 1- happine ss 2	-.08816	-2.208	35	.034

The study's hypothesis that there is a difference in happiness between sitting and playing a game is that the difference in mean value is – 0.8816 and the probability of t is – 2.208. In other words, the level of happiness before the game is 3.5423, and the degree of happiness after the game is shown relatively high in the result of 3.6304.

4.2.5 Relationship between immersion and happiness

Regression analysis was performed on the effects of immersion and happiness on work performance.

Table 25. Correlation Coefficient Of Engagement, Happiness And Operation Performance

		T3	happiness difference ALL	FSS
pearson correlation	T3	1.000	-.025	.332
	happiness ALL	-.025	1.000	.076
	FSS	.332	.076	1.000
significance proportionality	T3		.441	.021
	happiness ALL	.441		.325
	FSS	.021	.325	
N	T3	38	38	38
	happiness ALL	38	38	38
	FSS	38	38	38

This is to demonstrate Hypothesis ' H6 : Game immersion will affect performance. ' and 'H7: subjective happiness will affect work performance. '

It explained that the greater the change in happiness, the slower the work, and the more absorbed the work becomes, the faster it becomes. To determine if the results of this sample are still present in the population, perform a significance testing.

Table 26. Tests Of Statistical Significance About Happiness, Engagement And Business Hours (Walking)

model	statistic changes				
	R square change	F change	df1	df2	significance proportionality F change
1	.113	2.219	2	35	.124

If you are walking an experiment, the hypothesis is rejected because the p value is 0.124.

Table 27. Tests Of Statistical Significance About Happiness, Engagement And Business Hours (Sitting)

model	statistic changes				
	R square change	F change	df1	df1	significance proportionality F change
1	.090	1.626	2	33	.212

Similarly, the hypothesis is rejected because the group that sits down and performs the experiment also has less significance.

'H6 : Game immersion will affect performance.' and 'H7 : subjective happiness will affect performance.' Both hypotheses are unacceptable.

5. CONCLUSION

5.1 Summary

Figure 10 summarizes the present thesis.

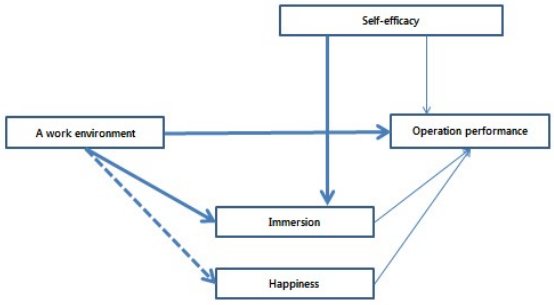

Figure 9. Research Model (Conclusion)

Finally, the following is the summary.

H1 : the work environment affects performance. Playing games with a smartphone while walking is faster to complete than sitting down.

(Reject) H2 : Computer skills will affect performance.

H3 : Computer skills have a positive effect on game immersion. People with higher computer skills tend to be more absorbed in games.

H4 : The work environment has a positive effect on immersion. He showed a higher level of immersion than sitting and playing games when playing games on a smartphone while walking.

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H5 : The work environment affects subjective happiness. The group that conducted the experiment in the walking environment did not feel happy, and the group that did the experiment with sitting down increased.
(Reject) H6 : Game immersion will affect performance.
(Reject) H7 : The subjective happiness will affect performance.

5.2 Discussion and Implications

Three experiments were conducted in this study. As you can see from the H5, it can be seen that the participants were stressed in the walking environment. Due to this effect, the first test results showed a better performance for the sitting groups. However, we can see that as the number of times we take two or three, the performance of the participants who are used to walking is getting better.

Table 28. Group Statistics And Independence Test Of The Experiment Excluding The First Test

	test type	N	average	standard deviation	standard error
T2T3A	walking	38	0:02:21	0:00:47	0:00:07
	sitting	36	0:03:21	0:01:18	0:00:13

We are already used to sitting and working conditions. It is regrettable that the results would have been more evident if there had been time for practice to inform and adapt to the working environment in which we were walking before starting the experiment.

5.3. Significance and Limitations of Research

5.3.1. Significance of research

The study found that the results did not change much while traveling around. On the contrary, they have better performance and immersion. Thus, these results can contribute to the establishment and settlement of a mobile office environment, a type of smart work. In addition, a working environment for walking around as well as using smartphones can be developed. Furthermore, the work environment and the study environment of students could change.

5.3.2 Limitation of Research

The limitations of this study can be summarized into five :
(1) Probability sampling methods were sampled using available sampling methods and studied. Since this is a non-probability sampling method, the sampling error can not be estimated. Results are less reliable because it is virtually impossible to estimate the value of the population.
(2) Samples were limited. The experiment was conducted on college students in their 20s who had relatively high computer skills. It is necessary to further expand the range of the population.
(3) We did not conduct a standing experiment or a running experiment. No standing experiment was conducted to compare differences with the existing standing desk. Also, although the literature revealed the claim that human beings are evolving in an upright direction rather than an upright walk, no running experiments were conducted.
(4) The time between the two groups was different. The group that did the experiment was measured on Monday, and the group that conducted the experiment sitting and sitting on Thursday.
(5) An experiment was conducted in a relatively safe place called a playground. Real roads have several obstacles, including cars, trees and telephone poles. There is an element of distraction. This is the biggest problem for a moving and working environment to become practical.

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