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GENDER ISSUES AFFECTING THE USE OF HUMANOID ROBOTS IN EDUCATION

BY

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Approval of Thesis

The undersigned certify that they have read the thesis entitled

GENDER ISSUES AFFECTING THE USE OF HUMANOID ROBOTS IN EDUCATION

Submitted by

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In partial fulfillment of the requirements for the degree of
Master of Science in Information Systems

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Dedication

This study is dedicated to The Almighty God, who is the source of all, knowledge and has been my strength, guide and shield all my life. Thank You Lord for your inspiration grace, protection, good health and courage without which it would have been impossible to complete this study.

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Abstract

Humanoid robots are gradually finding their way into various sectors of the society including the educational sector. Over the years various teaching methods have been introduced to the educational system to make it more effective. The use of learning objects such as humanoid robots in education is aimed at achieving this objective. For the humanoids to be successfully integrated into the educational sector, there is a need for comprehensive study of the humanoid robots and the factors that might aid or hinder their successful integration. This study will look at various gender issues such as attitude, preference, level of interaction and appearance. It will determine how these issues will affect the acceptance and integration of humanoid robots in the educational system. This will assist in the design of humanoid robots that can be more easily adopted by both students as well as teachers.

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1 Introduction

1.1 Motivation

Nelson Mandela (2003) once said that "education is the most important weapon which you can use to change the world" (n.d.) and according to B.F. Skinner (1964), "education is what survives when what has been learnt has been forgotten" (P. 483-4). The world is not static, its change is inevitable. The educational sector has evolved over time by adopting new technologies and ways of teaching and learning. It is gradually moving away from being paper based to becoming more electronic and computerized and in more recent time, from traditional classrooms to virtual online classes.

The learning process is dynamic because everyone has different learning styles, as such teaching must be delivered in such a way that everyone can understand. Within the first few minutes of a class, the students are either captivated or they have lost interest and their mind are already tuned to something else. The challenge teachers have is to find ways of keeping students interested and focused on the teaching such that it will hold students' attention long enough for them to understand what is being taught.

The present teaching system is not too effective because the students do not retain their understanding of what they are taught (Dunlosky, 2013). This is also proven in the Teaching and Learning International Survey (TALIS) done by the Organization for Economic Co-operation and Development (OECD, 2009), which suggested that the practices of many countries are yet to be transformed by the knowledge gained from education. Using Learning Objects or materials such as humanoid robots as teaching aids is one of the strategies aimed at making teaching or learning more effective.

Humanoid Robots are machines that have the form or functions of humans (La Russa, 2014). They come in different sizes and shapes and they can imitate human behavior and expressions (Kemp et al., 2010). They were introduced to the educational system to assist in the teaching and learning process. Shin and Kim (2007) in a study stated that robotics technology is more than ever becoming increasingly integrated into the field of education. Benitti in her study "exploring the educational potential of robotics

in schools" also confirmed that robots have found their way into the education system because of the advancement in technology that occurred in recent years (Benitti, 2012).

According to the International Federation of Robotics (IFR), about three million robots will be sold for use in education and research between the years 2016 and 2019 (IFR, 2016). This fact can be largely attributed to the appealing image of robots that young students have and to the fact that within the first few minutes of interaction with a humanoid robot, its visual appearance and human-likeness can trigger powerful social behaviors towards it. A thorough study of learners' psychology such as the gender factors is essential for a proper and effective integration of humanoid robots into educational programs which needs to be improved (Dunlosky et al., 2013).

1.2 Goal and Contribution

The goal of using learning objects in education is to make learning more effective and successful. One way of achieving this goal is to have a good understanding of students' perception and opinion of humanoid robots. It is important to study how the public will accept the humanoid robots into their daily life and what factors can prevent their acceptance. This understanding will assist researchers and developers in designing educational humanoid robots that are more users friendly and adaptable. It will also allow the development of different strategies of introducing students to robotic technologies by teachers and educators so young people with diverse interests and learning styles can be properly engaged (Rusk et al., 2008).

There are various factors that can serve as obstacles to the introduction of humanoid robots to the educational system such as the time-consuming nature of robotic activities, cultural issues, the use of either real or virtual robots, the cost of the equipment of the robots and the gender and difficulty-biased perceptions toward robots (Blikstein, 2013). This study will look at various gender issues that can affect the use of humanoid robots for educational purposes. It will consider issues such as: the attitudes of male and female students towards humanoid robots, their differing level of likeness for different types of humanoid robots, the different ways that male and female students interact with the

humanoids, as well as their humanoid robot gender preference. The focus of this study will be on the individual gender preferences of both male and female students for humanoid robots.

1.3 Thesis Organization

Chapter II discusses the relevant works done by many researchers in the field of humanoid robotics, humanoid robots in education and the gender issues that affect the integration of the two. It looks at problems currently being experienced in these fields and summarizes the findings from these researches. Chapter III focuses on the research questions, hypotheses and model. It develops the methodology and instrumentation of the study. Chapter IV tests the developed questionnaire for validity and reliability. Chapter V analyzes the data collected and verifies the hypotheses. It also discusses the result of the analyses. Chapter VI provides the discussion, conclusions and recommendations and suggests areas in which further work can be focused.

2 Literature Review

With the evolution of e-learning, e-banking, smart phones, smart cars, smart TV, smart boards and robots, the world is becoming more and more digital. According to Adams, these technologies will help to greatly enhance our collective way of living by freeing us from daily labors, serving as true companions and multiplying the realization of our creativity and intentions (Adams, 2005). The Greek philosopher Aristotle stated that "If every tool, when ordered, or even of its own accord, could do the work that befits it... then there would be no need either of apprentices for the master workers or of slaves for the lords" (Science Kids, 2015). It is therefore necessary for children to be taught how to manipulate all digital devices such as computers and humanoid robots to their benefits (Brittain, 2011).

2.1 Education before the use of Humanoid Robots

Knowledge is very important, right from the time a child is born his or her learning process begins. We must learn to eat, sit, crawl, walk, interact properly, and move from one level of growth to another, the process of learning never stops. Man must learn to survive in this very competitive world and the process of learning is continuous because the world itself is dynamic and not static, it changes every time. Learning is the process of acquiring knowledge. This can be the acquiring of new or the modification of existing knowledge. It is not only knowledge that is acquired in the learning process, skills, behaviors, values and information can also be acquired. There are various ways in which one acquires knowledge; it can be through formal education, personal development, schools and training.

The educational sector has gone through lots of phases and according to KAPLAN International College it has evolved from the time information was passed orally from one generation to the next to the present day where learning is mostly done in class rooms within the schools building (Robert, 2012). With the increase in population and the awareness of the importance of education especially in the third world countries, there are

more children in schools now than ever before. This increase has led to the traditional school system being plagued with many issues.

There are lots of complains about inadequate resources such as the school building being too small for the number of students ready to learn, the classrooms available are not enough for the students and the teachers are few. This has resulted in school classrooms having too many students in them making it difficult for the teacher to really spend adequate and quality time with each student to pass across the information to be taught. There is also not enough money to run the schools effectively. These frustrations between the teachers, students and the school board coupled with the revolution in information technology have led to the search for better style or means of learning.

Many schools now give assignment to students online and the students also submit their assignments online. Most schools in Canada use smart boards for teaching and they have access to the internet. More and more there is an integration of Information technology into every aspect of living. One of such technology that is daily gaining access is the humanoid robots. They can be found in the military, medicine, engineering, homes and even more presently in education.

2.2 Humanoid Robots

A robot is a machine designed to execute one or more tasks repeatedly, with speed and precision. It can be controlled by a human operator or by computer and electronic programming (Rouse, 2007). Leonardo da Vince in 1495 sketched the first picture of a human-like robot: a knight that could sit up, wave its arms and move its head and jaw. In 1920, Karel Capek first coined the word robot in his play “Rossums Universal Robots”. The word was used to describe machines that resemble humans (Robotics Research Group, 2015).

A humanoid is a robot with an appearance of the human body (Hirukawa et al., 2004). Its body resembles that of a human with a head, torso, legs, arms and hands. The humanoid robot is made to resemble a human both in appearance and behavior.

Humanoid robot resembles humans in behavior, gestures and movement (Duffy, 2003), and they can also express emotions making it possible for them to form social and emotional attachments with humans (Fong, Nourbakhsh, & Dautenhahn, 2003). The first humanoid robot was built in 1939, it was called Elektro. It was Seven feet tall and weighed 265 pounds. He could walk by voice command and speak about 700 words. Humanoid robots are designed to look as much as possible like humans. The male humanoid robots are called Androids (though it is used universally to refer to both male and female humanoid robots, it is meant for a male) while the female ones are known as Gynoids. Pictures of different types of humanoid robots can be seen in Figure 1 below.

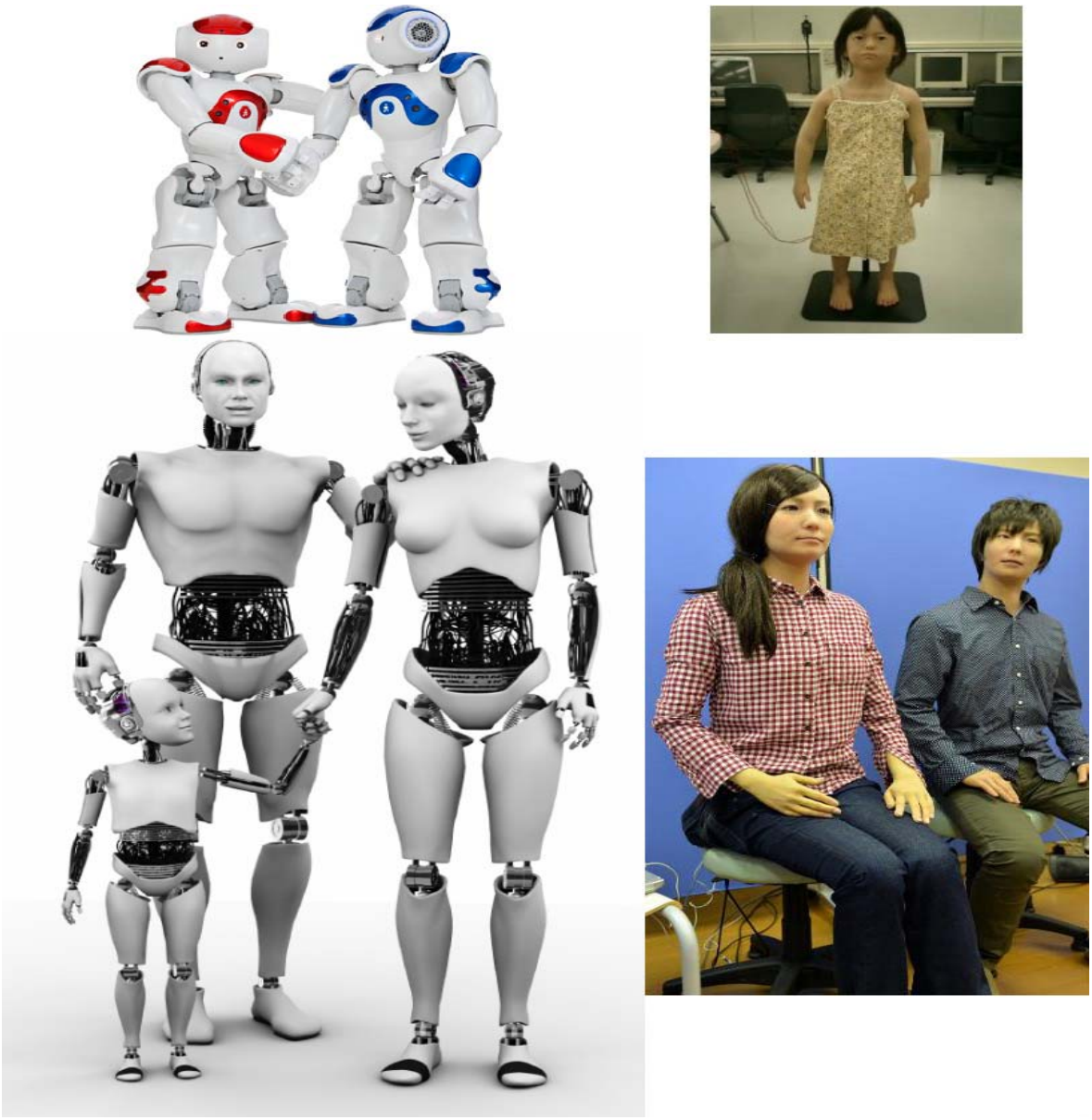


Figure 1. Humanoid Robot[1]

[1] https://goo.gl/images/ZTPVA8
https://goo.gl/images/uDPJjY
https://goo.gl/images/XXy7Ab
https://goo.gl/images/L85sXm

In 1990, real humanoid robots were developed. The initial aim of the humanoid robot research was the search for objects to use in replacing missing body parts especially the limbs. Humanoid robots have evolved over the years with humanoid robots becoming more flexible and mobile since they have found their way into many sectors of the society such as the entertainment industry, offices as assistants and into homes where they assist the elderly in their now difficult daily chores. Honda one of the leading developers of humanoid robots stated that the research into building humanoid robots began by envisioning the ideal robot form for use in human society. The researchers had to put into consideration the tasks the humanoid robots will be performing which might require them to be able to climb stairs, maneuver between objects, bend down to lift or pick objects (Honda, 2015). Humanoid robots are also now being used in the education sector.

2.3 Humanoid Robots in Education

Technology has revolutionized education by changing the teaching and learning methods (Cuban, 2003; Selwyn, 2016). Recent trend in education shows that humanoid robots are now becoming more integrated into the system (Chang et al. 2010). Many schools have integrated or are integrating robotics courses into their curriculums. Their introduction as technological tools is seen as a means of creating greater knowledge in various fields such as science, technology, mathematics, mechanical engineering, electrical engineering, control, computer science, communications, psychology and biology (Keane et al., 2016).

Humanoid robots were first introduced to the educational system in the late 1980s as a teaching tool. They were used to teach robotic courses as well as other courses such as engineering, science, biology and psychology (Demetriou, 2011). According to Omar et al. (2010), robots are becoming an integral component of our society and can be greatly utilized in the educational sector. He further stated that it has become necessary and important to study how best to integrate robots into the system to make the maximum positive impact. There are many studies that are geared towards the integration of humanoid robots in education many of them have proven the fact that with proper

integration, humanoid robots can make learning more effective for students because learning with humanoid robots is very absorbing and enjoyable for many children and adults (Price et al, 2003) and technological skills are developed when students learn to construct robots (Liu, 2010).

In their study, Tanaka et al. (2007) placed a social humanoid robot into a classroom of toddlers for about five months. Their findings suggested that children were able to bond and socialize successfully with humanoid robots which would be a great assistance to the teachers. Tanaka and Matsuzoe (2012) conducted an experiment in which a care-receiving robot was introduced to an English class to observe the effect of the robot's presence on children's learning. They observed that children with the robot present in class during teaching recalled more words than the children in which the robot was not present. In another study, IROBI a sitting child-like robot was designed to present an English dialogue to fifth and sixth grade students. The same dialogue was given to other sets of students via books with audiotape and web-based instructions (WBI). The results also showed that the humanoid robot improved the student's concentration and interest better than the traditional methods (Jeonghye et al., 2008).

Humanoid robots do not only have their uses in reading, language, entertainment, science, mathematics and technology, they have also found their uses as well as in hygiene education. Some schools in Canada use humanoid robots in teaching health and hygiene education. Kohlhepp reported that in the Livingston Park and North Brunswick districts in Canada, a life-size interactive robot, called Caring Coach has been used successfully to teach children fitness and healthy living (Kohlhepp, 2003). Studies in STEM (Science, Technology, Engineering and Mathematics) also improved greatly when humanoid robots were introduced to the students because the humanoid robots enabled the students to learn and visualize the STEM concepts at a higher and better level (Felicia & Sharif, 2014).

Bushnell and Crick (2003) in their research on control education via autonomous robotics concluded that when student learn by designing, building and operating robots they become highly skilled in electrical, mechanical, and computer engineering fields.

This confirms that humanoid robots can effectively teach students the somewhat difficult courses (Jeonghye et al., 2008).

Very young children and preteens also benefits from the integration of humanoid robots into their classrooms. In their studies, Bers et al. (2014) introduced a new curriculum design called TangibleK which exposed the children to robotics programming concepts and computational thinking. They were able to show that children even as young as four years can learn many aspects of robotics programming. Exposure to robotics also allows children to learn responsibility, communication, cooperation as well as decision taking (Cole & O'Connor, 2003). In a pilot study by Barker & Ansorge (2007), the achievement scores of youth between the ages 9 and 11 were improved when the students were introduced to a curriculum based on robotics. The students in the study were divided into two groups, those in the robotics intervention and those in a control group. Their test scores were examined and compared, and the result showed that the robotic program made the student's result better.

Many more studies also show how the introduction of humanoid robot into the schooling system improved the learning process, for example, Lin et al. (2014) investigated the development of a service robot for children's library. The study was conducted in two phases. The first phase performed the sampling of library stakeholders such as children, librarians and parents. They were interviewed to obtain their impressions and expectations for use of humanoid robots in the library. In the second phase, they developed a functional prototype service robot that was placed in a children's library for formative assessment by target users as confirmation testing. They found that the humanoid robot was able to assist the children in the search for books and it also met the librarians' expectations for a substitute agent. The library humanoid robot connected the library resources with the children who were thus motivated to explore and enjoy the library making it important to study how the humanoid robots were able to achieve this.

In a school in the Harlem area of New York City, children participated in computer programming activities using a programming language called CHERP to program humanoid robot's behaviors. The children used Lego part to build recyclers they then

programmed the recyclers to assist in carrying and sorting recyclable materials found in the classroom. Researchers observed the students and then documented their activities. Result of their findings show that the teachers successfully integrated robotics work into their classrooms and by so doing they were able to train the students in mathematical, literary as well as artistic concepts which they used in developing the robotic recyclers (Sullivan et al, 2013). The study on humanoid robots and computational thinking, Keane et al. (2016) showed that engagement with humanoid robots promotes creativity, critical thinking, collaboration, curiosity, communication and the development of high-level skills in computational thinking.

In their study, on how to use humanoid robots to facilitate language teaching, Chang et al. (2010) showed that the highly mobile and repetitive nature of humanoid robots used in their test made the students' sessions with the humanoid robots very interactive and engaging. But they also noted that the humanoid robots could not adequately portray emotion. When Chen & Chang deployed humanoid robot to the classroom to examine the use of humanoid robots as instructional media in elementary language education, they found that humanoid robots have unique features that give them the potential to be useful for teaching language education. However, the study does not specify which features of the humanoid robots or that of the students makes them acceptable (Chen & Chang, 2008).

Some of these studies brought up issues that needed to be resolved before humanoid robots can be fully integrated into the educational sector. Though humanoid robots had the ability to improve learning the studies also revealed that for humanoid robots to be fully effectively, details such as the appearance, voice and gender of the humanoid robot will have to be carefully and thoughtfully planned.

2.4 Gender Issues

According to United Nations Women's definition, gender refers to the social attributes and opportunities associated with being male and female and the relationships between women and men, girls and boys. These attributes, opportunities and relationships

are socially constructed and are learned through socialization processes. They are context or time-specific and changeable. They further stated that gender determines what is expected, allowed and valued in women and men in a given context and that in most societies there are differences and inequalities between women and men in responsibilities assigned, activities undertaken, access to and control over resources, as well as decision-making opportunities (UN Women, 2013). Gender is the economic, social, political and cultural attributes and opportunities, associated with being male and female. These attributes contribute in making a male different from a female (Tannen, 1990).

From childhood to adulthood many differences are manifested in all the male and female activities. According to Rybska et al. (2014), children formulate ideas about natural objects at an early age, and these ideas are often resistant to change. These influences and ideas that develop early in childhood are a result of factors as socio-economic status, parents' occupation and education levels, and parental expectations (Domenico & Jones, 2007). They can also be attributed to the children's individual socio, cultural, economic and emotional characteristics. These characteristics play significant roles in structuring the social behavior of males and females and as they grow older the factors become more influential.

According to Eyssel & Kuchenbrandt (2012), people often automatically use cues such as a person's gender, age, or ethnicity to categorize and form impressions of others and these cues are also used in categorizing humanoid robots when in contact with them. Nass and Moon (2000) observed that people instinctively treat computers like humans, by applying human social categories such as ethnicity and gender to them. Gender also influences what type of groups one affiliates with (Kuh, Hu, & Vesper, 2000). Sara Lång concluded in her study on gender perspective on educational facilities that understanding how children use their physical environment, will help us to understand how children conceptualize gender inside and outside the classroom, thus identifying themselves as girls and boys (Sara Lång, 2010).

Not only does the gender of student influence their behaviors, but also that of their teachers can also influence them. Catherine Krupnick concluded in her study: Women and Men in the Classroom, that a teacher's gender can influence the extent to which male students dominate classrooms (Krupnick, C.G., 1985). Similarly, Powers and colleagues have shown that a humanoid robot's behavior, its tone of voice, or appearance constituted key cues for subsequent judgments about the robots (Powers & Kiesler, 2006; Powers et al., 2005). Vinesh concluded from his own study that humanoid robots' appearance and user-friendly nature makes them able to capture children's attention which will have an impact on how they are accepted by the students (Vinesh, 2010). These findings indicate that the appearance and physic of the humanoids are important in the success of the integrated of humanoid robots into the educational system.

Humanoid robots can be found interacting with humans in different areas of human life as recyclers, teachers, library assistants, toys and even companions for the elderly. To gain better acceptance, cooperation and response from people, humanoid robots must be able to make people comfortable with them while fulfilling whatever duties assigned for them to perform. Hence, the nature of a humanoid robot's appearance and demeanor must aid people's acceptance and response to it since a humanoid robot's appearance or demeanor can influence people's perceptions and their willingness to comply with it (Powers et al., 2005).

Nomura et al. (2012) examined the social acceptance of humanoid robots in Japan. They developed psychological tool for measuring the acceptance of humanoid robots. They explored the factors that influence the acceptance, such as the effects of age, gender and experiences with humanoid robots. Their findings show that younger people in Japan do not accept the development of humanoid robots as strongly as older people do, but results were inconclusive about whether gender had anything to do with these choices.

Whereas in the study to investigate the effects of gender on human-robot interaction by Alexander et al., the results showed that males sought more help from the humanoid robots than the females and that both the males and females preferred to work with the male humanoid robot. In this study 48 participants completed four Sudoku puzzles with a

humanoid robot from which they could ask for help. The humanoid robot was given a gendered name and characteristics and the participants could be randomly assigned to either a male or female robot. Data was collected and analyzed. They concluded that human-robot interactions can be affected by gender cues (Alexander et al., 2014).

This was also proven when parents' perceptions of educational humanoid robots and the effect of gender on socio-economic differences were studied. Questionnaires were administered to thirty-nine parents, whose children study in a junior high school in which a robotics club had been established for two years. Seventeen of the parents were male and 22 were female. The results showed that the parents had positive attitude towards educational humanoid robots because the humanoid robots not only enhanced students' learning motivation but also improved students' learning. It also showed that males had more positive attitude towards educational humanoid robots than females (Lin et al., 2012).

Siino and Hinds conducted a study to analyze men's and women's behavior with humanoid robots introduced into the work place. They studied how sex segregation of jobs may impact the way men and women make sense of robots. A mobile humanoid robot was introduced into a community hospital to serve as a courier. The workers were observed in their daily dealings with the humanoid robot and data about their interactions and reactions to the robot were collected by observation and interviews. Using Strauss and Corbin's methods, the data were coded and analyzed. The result shows that engineers and male administrators generally saw the robot as a machine that they could control; female administrators and low-level female staff workers saw the humanoid robot as a human male working with agency and nurses, predominantly female, saw the humanoid robot as their replacement.

Male and females differ in their thinking, emotions, abilities, reasoning, decision taking and the ways they communicate and interact with other humans and objects (Tannen, 1990). Gender affects how male and female students will interact, like and accept the humanoid robots. It also a determining factor in the attitude of students to the humanoid robots. Gender plays significant roles in how males and females categorize and

accept humans and humanoid robots (Kuh, Hu, & Vesper, 2000). This research will study the various gender issues that might aid or hinder the acceptance of humanoid robots by student as well as teachers as into the education system as teaching aids.

3 Analysis and Design

From the literature reviewed, humanoid robots have been shown to be beneficial to the educational system. The literatures have also revealed some limitations in the studies in that they do not really show exactly how the humanoid robots have been able to achieve this. In this chapter, I will focus on the research model, questions and the hypotheses.

3.1 Research Model, Questions and Hypotheses

The arguments in the literatures that have been reviewed are the basis of relevance for the following research questions which will be tested and answered:

1) Do male students and female students have different attitudes toward humanoid robots?
2) Do male students and female students have different interactive ways, level and frequency with humanoid robots?
3) Do male students and female students like the same or different types of humanoid robots?
4) Do male students and female students have different perception of humanoid robot and their roles?
5) Does the gender of humanoid robots have any effect on how male students and female students accept humanoid robots?

This research believes gender differences in the classroom deserve attention because potentially they influence the academic, behavior and the social lives of students. I will like to find out whether male and female students differ in their preferences for humanoid robots and how exactly they differ if they do.

In this research, I explored the relationship between students' gender and their perceived attitudes towards the humanoids, their perceived role of the humanoids and their perceived preference for which humanoid gender. This research has three variables

namely role, attitude and humanoid gender. Figures 2 and 3 show the macro and micro views of this research model respectively.

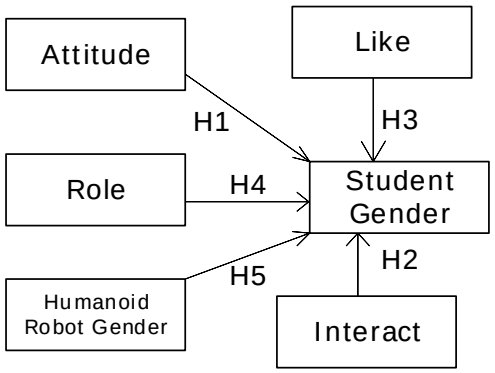


Figure 2. Macro view of the proposed research model

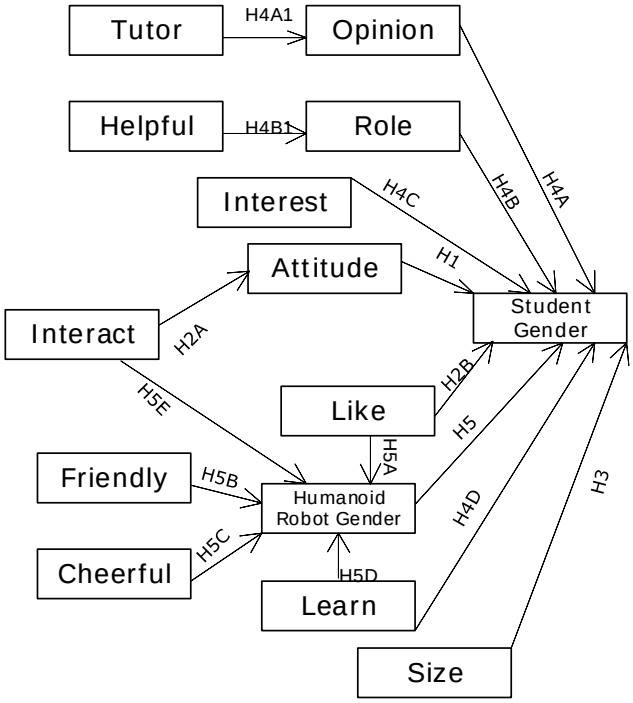


Figure 3. Micro view of the proposed research model

This study will try to determine the gender issues that might aid or hinder the acceptance of humanoid robots by student as well as by teachers or tutors as teaching aids for them. It will also determine male and female student's attitude, likeness and level of interaction with humanoid robots. This research has the following hypotheses:

Table 1. Hypotheses

	HYPOTHESES
H1	Female students have more positive attitude towards humanoid robots than male students
H2A	Female students interact more positively with humanoid robots than male students
H2B	Female students like humanoid robots more than male students
H3	Female students are different from male students in their humanoid robot size preference
H4A	Female students' opinion of humanoid robots is different from that of male students
H4A1	Female students think that humanoid robots will make good tutors while male students don't
H4B	Female students' perception about humanoid robots' role is different from that of male students
H4B1	Female students wish to have humanoid robots as helpers in class while male students don't
H4C	Female students show more positive interest in humanoid robots than male students
H4D	Female students wish to learn more about humanoid robots while male students don't
H5	Humanoid robots' gender affects how male and female students will accept them
H5A	Female students differ from male students in their opinion of what humanoid robots' gender should be
H5B	Female students differ from male students in their opinion that female humanoid robots are friendlier than male humanoid robots
H5C	Female students differ from male students in their opinion that female humanoid robots are more cheerful than male humanoid robots
H5D	Female students differ from male students in their preference to learn from female Humanoid robot more than male humanoid robots
H5E	Female students differ from male students in their preference to interact more with female Humanoid robot than male humanoid robots

3.2 Instrument

The focus of this research is to know the preferences and perceptions toward humanoid robots that both male and female students may have. The research collects the data through a survey and uses statistical analysis approaches to verify these hypotheses. A reliable and valid questionnaire is designed and piloted for this purpose. A questionnaire is needed for understanding how students perceived the gender and roles humanoid robots have. An existing questionnaire is adopted and altered for suiting the

research goal. The existing questionnaire was developed by Prof Tzu-Chen Liu for one of his previous similar study. I modified and reworded his questionnaire to make it appropriate for this study.

Some questions that were not relevant to my study were removed while some new questions were added. There are thirty-nine (39) items in the altered questionnaire including sixteen (16) items for getting students' perceptions and attitudes toward humanoid robots, their gender and role for education purpose. These items are used for testing three factors: gender, attitude and role. The revised questionnaire is made up of four parts. Part 1 is divided into two sections comprising of the demographics and short answer questions which collects student's information and his or her opinion and preference for humanoid robots as listed in Table 2.

Table 2. Part 1 Demographics & Short Answer Items

Factor	Items
Short Answer Questions	I am a __ My race is __ Q1 - I knew what a humanoid robot was when I was about __ years old Q2 - The most common way that I got information about humanoid robot is Q3 - In all my toys, I like ___ most Q4 - I have the following ideas about humanoid robot ___ Q5 - If I had a humanoid robot, I would want it to __

Part 2 comprises of six (6) gender relevant items with scale ranging from 1 for "Male", 2 for "Female", 3 for "Both Male & Female" to 4 for "No Gender" for understanding students' perceived robot genders as listed in Table 3.

Table 3. Part 2 Gender Items

Factor	Items
Gender	Q6 - I believe humanoid robot should be Q7 - Which humanoid robot do you think will be more cheerful? Q8 - Which humanoid robot do you think will be friendlier? Q9 - If you were to choose, which humanoid robot will you interact with? Q10 - Which humanoid robot will you prefer? Q11 - If you were to have humanoid robot as a teaching assistant in class, which one would you prefer to learn from?

Part 3 comprises of six (6) five-point Likert-scale items (where 1 is for “Strongly Agree” to 5 “Strongly Disagree”) for getting student’s perceived preference for and behavior towards the humanoid robots and four (4) five-point Likert-scale items for getting the students' perceived opinion on humanoid robots' role as tutors or teaching assistants. The items can be found in Table 4.

Table 4. Part 3 Five-Point Likert-Scale Items

Factors	Items
Role	Q14 - Humanoid robots will make good teaching assistants in class. Q15 - I wish to have a humanoid robot as a teaching assistant in class Q16 - Humanoid robots will make good tutors Q17 - I wish schools will have a class teaching robot related knowledge
Attitude	Q12 - Humanoid robots are amazing creatures Q13 - I am interested in the humanoid robot stuffs Q18 - I will enjoy interacting as a friend with humanoid robots Q19 - I have some doubts about humanoid robots Q20 - I don't like humanoid robots Q21 - I like humanoid robots

Part 4 is made up of two (2) items on size preference as well the robot selection of pictures and video clips. I choose different pictures of humanoid robots (male, female, adult & child) and I also made video clips of several humanoid robots as seen in Table 5. The full questionnaire can be found in Appendix A.

Table 5. Part 4 Size, Picture & Video Items

Factors	Items
Pictures	From the pictures, I like __ best I also like __ Check__ if you don’t like any
Videos	From the following video clips, I like __ best I also like __ Check___ if you don’t like any
Size	I prefer larger adult size humanoids I prefer mini child size humanoid robots

3.3 Methodology

This research is conducted in two phases. In the first phase, a pilot survey runs for collecting students' responses and testing the validity and reliability of the designed questionnaire. At the end of first phase, the questionnaire is further refined based on the data analysis results. In the second phase, the valid and reliable questionnaire is used to conduct the official survey. The data collected by the refined questionnaire is still going through the validity and reliability test before the statistics data analysis methods are adopted to verify the hypotheses and find the answers of the research questions.

The questionnaire was built with an open source free online questionnaire hosting service, Lime Survey, hosted by School of Computing and Information Systems, Athabasca University. The students' responses are stored in the server hosted at Athabasca and then downloaded into excel file that can be further analyzed. There is no confidentiality and privacy concerned data collected as the participants' names are not in the returned survey data but only their study ID. Each participant the humanoid robot will generate a study ID prior to data collection. They will use the ID during the survey instead of their names. There is no connection between study ID and the participant's name or any other identifiable data. Each participant will be given instructions on how to create his or her own study ID based on a set of items that will not change over time. The items will not be any of the personal identifiable materials. The full instructions can be found in Appendix B

The pilot and official survey were conducted both in Nigeria and Taiwan. For high school in Nigeria, I approached the principal of Acada High School to obtain permission to conduct the survey in her school. Upon her approval I received an approval letter from her. On the other hand, to get high school students to participate the surveys in Taiwan, I worked in collaboration with Prof. Vincent Ru-Chu Shih and Prof. Shi-Jer Lou. They assisted in obtaining permission to conduct the survey in Shilizhangyi High School. My supervisor, Prof. Maiga Chang, kindly helped to further translate the items in the altered questionnaire written in English to Chinese for students to understand and fill out the questionnaire. The students' responses were also translated back to English by him.

The students were sent home with introductory letters and consent form for their parents asking for permission for their child or ward to take part in the survey. The parents as well as the students had to sign the consent forms as the students were underage. Once the consent forms were received back, the pilot survey was conducted online. The approval letters and consent forms can be found in Appendix C. The survey plan and the questionnaire has been reviewed and approved by Athabasca University's Research Ethics Board. The certificate can be found in Appendix E.

4 Questionnaire Refinement

One hundred and six feedbacks were received from Taiwan. 50 students from grade 7 and 56 students from grade 8 participated in the pilot test and there was no feedback from any grade 9 students. Participants ranged from ages 11 to 16. Another one hundred and seventeen feedbacks were received from Nigeria. 52 students were from grade 7, 39 students from grade 8 and 26 students from grade 9. Participants ranged from ages 10 to 16. These can be seen in Table 6. The students' responses from the pilot survey were thoroughly analyzed to test the validity and reliability of the questionnaire.

Table 6. Descriptive Statistics for Grade, Age and Sex

Grade	Taiwan	Nigeria
Grade 7	50	52
Grade 8	56	39
Grade 9	0	26
Total	106	117
Sex		
Male	50	58
Female	56	59
Total	106	117
Age		
11	0	19
12	1	31
13	36	39
14	42	15
15	25	7
16	2	2
Total	106	117

4.1 Reliability and Validity Test

Though this questionnaire was adopted from previous research results and its validity and reliability have already been proven by other researchers, I still must test its validity and reliability again since some items were removed and others were added to make the questionnaire suitable for this research.

The reliability of an instrument is the accuracy or precision of the measuring instrument. Reliability test is performed on the responses of the pilot survey. There are different types of reliability test available such as: test-retest split half, alternate form and internal consistency. The choice of which one to use depends on the nature of data. I choose the Cronbach's alpha values to test for the reliability of the questionnaire designed in this research with statistical software SPSS' help. The reliability of each factor was tested, factors with reliability coefficient ranging between 0.70 to 0.95 have an acceptable value (meaning the more reliable the test scores), any value less than 0.70 is questionable (Nunnally, 1978).

The validity of an instrument is the extent to which the instrument accurately measures what it is supposed to measure. There are various tests for validity such as construct validity, content validity and criterion validity. The validity of the questionnaire designed was tested using Principal Component Analysis with Varimax rotation with statistical software SPSS' help. The items' validities within the factors were assessed. The items with negative or low factor loadings (< 0.5) imply that the item may not relate well with all the other items meaning they do not measure the same thing as the other items (Hair et al., 1998). The responses of the pilot survey conducted in Nigeria and Taiwan were analyzed for reliability and validity separately as well as together. The analysis was performed part by part (Likert-scale items, Image & Video items and general information items) and discussed below.

4.2 Assessing Likert-scale Items – Nigeria

Cronbach's alpha analysis was performed on the Likert-scale and Gender items to test their reliability. The results are listed in Table 7. The Cronbach's alpha value for the Gender factor is quite good at 0.798 making the factor reliable. The Cronbach's alpha value for the Role is not too poor at 0.681. The alpha value for the Attitude factor is quite poor at 0.372, this suggest that it has a questionable reliability. However, further look at the possible Cronbach's alpha value changes when an item is removed; the Attitude factor has now improved to an almost acceptable value when item Q19 is removed.

Table 7. Cronbach's alpha values of the Questionnaire – Nigeria

Factors	Item Amount	Cronbach's alpha	Cronbach's alpha if item is deleted
Gender	6	*.798*	Q6 – 0.788 Q7 – 0.793 Q8 – 0.764 Q9 – 0.740 Q10 – 0.769 Q11 – 0.741
Role	4	*.681*	Q14 – 0.574 Q15 – 0.537 Q16 – 0.651 Q17 – 0.674
Attitude	6	*.372*	Q12 – 0.266 Q13 – 0.358 Q18 – 0.240 *Q19 - 0.550* Q22 – 0.337 Q23 – 0.240

Table 8 lists the items designed for Role factor and their component loadings. The result shows that all the items have high factor loading value and the factor is valid.

Table 8. Component Analysis for items of Role Factor – Nigeria

	Components
	1
Q15	0.806
Q14	0.776
Q16	0.655
Q17	0.616

Extraction Method: Principal Component Analysis
Rotation Method: Only one component extracted, it cannot be rotated

Table 9 show items Q12 & Q13 with low factor loadings when aggregated with the Attitude factor and high loadings when separated into another factor. Q19 item has factor loading that is low for all factors, meaning it is not substantially related to the other measures and may not be grouped with them. The other measures form a coherent component.

Table 9. Component Analysis for items of Attitude factor – Nigeria

	Components	
	1	2
Q23	**0.774**	0.186
Q18	**0.726**	0.239
Q22	**0.702**	-0.256
Q12	**0.209**	***0.794***
Q13	**0.138**	***0.507***
Q19	**-0.225**	***0.465***

Extraction Method: Principal Component Analysis
Rotation Method: Varimax with Kaiser Normalization
Rotation converged in 3 iterations
Bold: item's factor loading is over 0.5 for the pre-defined component
Bold and underlined: factor loading for the component is less than 0.3
Bold and italic: factor loading is over 0.3 for another component

When the research team reviewed students' responses of the other short-answer questions, we found that some students treat humanoid robots as advanced technology or even alien's technology – the latter thoughts might be influenced by the movie "Transformers". This finding might explain the responses that students have for item Q12 "Humanoid robots are amazing creatures" since not everyone treats humanoid robots as creatures. On the other hand, for Q13, after reviewing the students' responses, we found out that of the 117 responses only 12 would like to have robots as toys, meaning that

"they are not interested in humanoid robot stuffs". This might explain why the factor loading for Q13 is low. When item Q19 was analyzed, it asked students whether they have doubt about humanoid robots, and because students may not quite understand what exactly "doubts" means, this might be the reason for their responses to item Q19. Item Q19 will therefore be removed.

Since items Q12 & Q13 show low factor loadings when aggregated with the Attitude factor and high loadings when separated into another factor, these items will be removed from the Attitude factor. Principal Component Analysis was performed on the remaining items of the Attitude factor and the result is seen in Table 10. All the three items have high factor loadings, and this makes the attitude factor valid.

Table 10. Component Analysis Revised Attitude Factor – Nigeria

	Component
	1
Q23	**0.811**
Q18	**0.771**
Q22	**0.659**

Extraction Method: Principal Component Analysis
Rotation Method: Varimax with Kaiser Normalization
Bold: item's factor loading is over 0.5 for the pre-defined component

The Cronbach's alpha test was repeated after the changes were made to the attitude factor. As seen in Table 11, the Cronbach's alpha value for the attitude factor has now increased to low but acceptable value of 0.605.

Table 11. Updated Cronbach's alpha values three factors– Nigeria

	Components	
	1	2
Q23	**0.774**	0.186
Q18	**0.726**	0.239
Q22	**0.702**	-0.256
Q12	**0.209**	***0.794***
Q13	**0.138**	***0.507***
Q19	**-0.225**	***0.465***

Extraction Method: Principal Component Analysis
Rotation Method: Varimax with Kaiser Normalization
Rotation converged in 3 iterations
Bold: item's factor loading is over 0.5 for the pre-defined component
Bold and underlined: factor loading for the component is less than 0.3
Bold and italic: factor loading is over 0.3 for another component

4.3 Assessing Likert-scale Items – Taiwan

Cronbach's alpha analysis was performed on the Likert-scale and Gender items of the responses from Taiwan to test their reliability. The results are listed in Table 12. The Cronbach's alpha value for the Gender factor is quite good at 0.872 making the factor reliable. The Cronbach's alpha values for the Role and Attitude factors are at 0.567 and 0.658 respectively, this suggest that they have questionable reliability. However, further look at the possible Cronbach's alpha value changes when items were removed. The Attitude factor will have a good value of 0.707 when item Q19 is removed and the Role factor will have a low but acceptable value of 0.624 when item Q14 is removed.

Table 12. Cronbach's alpha values of Questionnaire – Taiwan

Factors	Item Amount	Cronbach's alpha	Cronbach's alpha if item is deleted
Gender	6	0.872	Q6 – 0.858 ***Q7 – 0.874*** Q8 – 0.830 Q9 – 0.827 Q10 – 0858 Q11 – 0.847
Role	4	*0.567*	***Q14 – 0.624*** Q15 – 0.442 Q16 – 0.469 Q17 – 0.500
Attitude	6	*0.658*	Q12 – 0.633 Q13 – 0.619 Q18 – 0.484 ***Q19 – 0.707*** Q20 – 0.559 Q21 – 0.578

Table 13 lists the items designed for Role factor and their component loadings. The result shows that all the items have enough factor loading value. Although item Q14 has the lowest loading value, the factor is still valid.

Table 13. Component Analysis for items of Role Factor- Taiwan

	Component
	1
Q15	0.770
Q16	0.734
Q17	0.657
Q14	0.608

Extraction Method: Principal Component Analysis
Rotation Method: Only one component extracted, it cannot be rotated

To further test to see whether the individual items of the Role factor have consistent internal reliability, the Average inter-item correlation analysis was performed on them. Table14 shows the result of the analysis. From table 15 we can see that mean correlation value is 0.308 which indicates that the items have optimal internal consistency (Briggs & Cheek, 1986).

Table 14. Inter-Item Correlation for Role Factor-Taiwan

	Mean	Minimum	Maximum	Range	Maximum /Minimum	Variance	N of Items
Inter-Item Correlation	.308	.246	.467	.220	1.893	.006	4

Table 15 show items Q12 & Q19 with low factor loadings when aggregated with the Attitude factor and high loadings when separated into another factor. Results suggest that these items are not substantially related to the other measures and may not be grouped with them.

Table 15. Component Analysis for Attitude factor – Taiwan

	Components	
	1	2
Q21	**0.826**	-0.086
Q20	**0.809**	0.073
Q18	**0.736**	0.142
Q13	**0.539**	0.236
Q19	**-0.079**	***0.828***
Q12	***0.289***	***0.691***

Extraction Method: Principal Component Analysis
Rotation Method: Varimax with Kaiser Normalization
Bold: item's factor loading is over 0.5 for the pre-defined component
Bold and underlined: factor loading for the component is less than 0.3
Bold and italic: factor loading is over 0.3 for another component

When the research team reviewed students' responses of the other short-answer questions, we found just as in the Nigerian case that some students treat humanoid robots as advanced technology or even alien's technology – the latter thoughts might be influenced by the movie "Transformers". This finding might explain the responses that students have for item Q12 "Humanoid robots are amazing creatures" since not everyone treats humanoid robots as creatures. On the other hand, for Q19, it asks students whether they have doubt on the robots. Students may not quite understand what exactly "doubts" means. Therefore, item Q19 will also be removed as was done in the Nigerian analysis. Since item Q12 is also showing inconsistency in the Taiwan analysis, it will also be removed from the questionnaire. Last but not the least, Q13 has factor loading value that is less than 0.6; therefore, Q13 will also be removed as was done for the Nigerian analysis. Principal Component Analysis was then performed on the remaining items of the Attitude factor. As seen in Table 16, all the items have good factor loading value and the role measure forms a coherent component.

Table 16. Component Analysis Revised Attitude Factor – Taiwan

	Component
	1
Q22	**0.852**
Q23	**0.848**
Q18	**0.738**

Rotation Method: Varimax with Kaiser Normalization
Rotation converged in 3 iterations
Bold: item's factor loading is over 0.5 for the pre-defined component

The Cronbach's alpha test was performed again after the items with low factor loadings and the difficult to answer item were removed and revised accordingly. As seen in Table 17, the Cronbach's alpha value for the Attitude factor increased to a good value of 0.742 and the value for Role factor is still slightly poor at 0.567 but with good internal consistency.

Table 17. Updated Cronbach's alpha three factors – Taiwan

Factors	Item Amount	Cronbach's alpha	Items
Gender	6	**0.872**	Q6, Q7, Q8, Q9, Q10, Q11
Role	4	**0.567**	Q14, Q15, Q16, Q17
Attitude	3	**0.742**	Q18, Q22, Q23

4.4 Assessing Likert-scale Items – Nigeria & Taiwan Combined

Cronbach's alpha analysis was performed on the Likert-scale and Gender items of the combined responses from both Nigeria and Taiwan. The results are listed in Table 18. The Cronbach's alpha values for the gender, attitude and role factors are quite good at 0.850, 0.732 and 0.705 respectively making these factors reliable.

Table 18. Cronbach's alpha values Questionnaire - Nigeria & Taiwan

Factors	Item amount	Cronbach's alpha	Cronbach's alpha if item is deleted
Gender	6	**0.850**	Q6 - 0.835 Q7 - 0.856 Q8 - 0.816 Q9 - 0.800 Q10 - 0.830 Q11 - 0.810
Role	3	**0.629**	Q15 - 0.432 Q16 - 0.546 Q17 - 0.593
Attitude	3	**0.732**	Q18 - 0.708 Q22 - 0.663 Q23 - 0.552

From the analyses performed on the Nigerian and Taiwan responses, the final questionnaire is refined based on these results. The final revised questionnaire to be used in both Nigeria and Taiwan is listed in Table 19 below:

Table 19. Final Refined Questionnaire

Factors	Item amount	Cronbach's alpha	Items
Gender	6	0.857	Q6, Q7, Q8, Q9, Q10, Q11
Role	4	0.705	Q14, Q15, Q16, Q17
Attitude	3	0.732	Q18, Q22, Q23

The numbers of the items of the revised questionnaire were also revised and they are as seen in Table 20.

Table 20. Part 3 Five-Point Likert-Scale Items

Factors	Items
Role	Q14–I think Humanoid Robots will make good TA (C12.) Q15 - I wish to have a humanoid robot as a teaching assistant in class (C14.) Q16 - Humanoid robots will make good tutors (C15.) Q17- I wish schools will have a class teaching robot related knowledge (C16.)
Attitude	Q18 - I will enjoy interacting as a friend with humanoid robots (C17.) Q22 - I don't like humanoid robots (C18.) Q23 - I like humanoid robots (C19.)

The revised questionnaire can be found in Appendix D.

5 Evaluation

The revised questionnaire was used in the second phase to conduct the final survey in Nigeria and Taiwan. Two hundred and twenty-nine (229) feedbacks were received from Nigeria, ninety-nine (99) of which were males and one hundred and thirty (130) females. A total of ninety-eight (98) feedbacks were received from Taiwan, with forty-three (43) of them males and fifty-five (55) females. I analyzed the data with descriptive and quantitative statistical methods. The descriptive analysis in Table 21 shows a summary of the dataset, and the quantitative analysis reveals the relations among the factors. The research questions and hypotheses will be answered, and the findings discussed at the end of this chapter.

Table 21. Descriptive Stat-Grade, Age & Sex revised Questionnaire

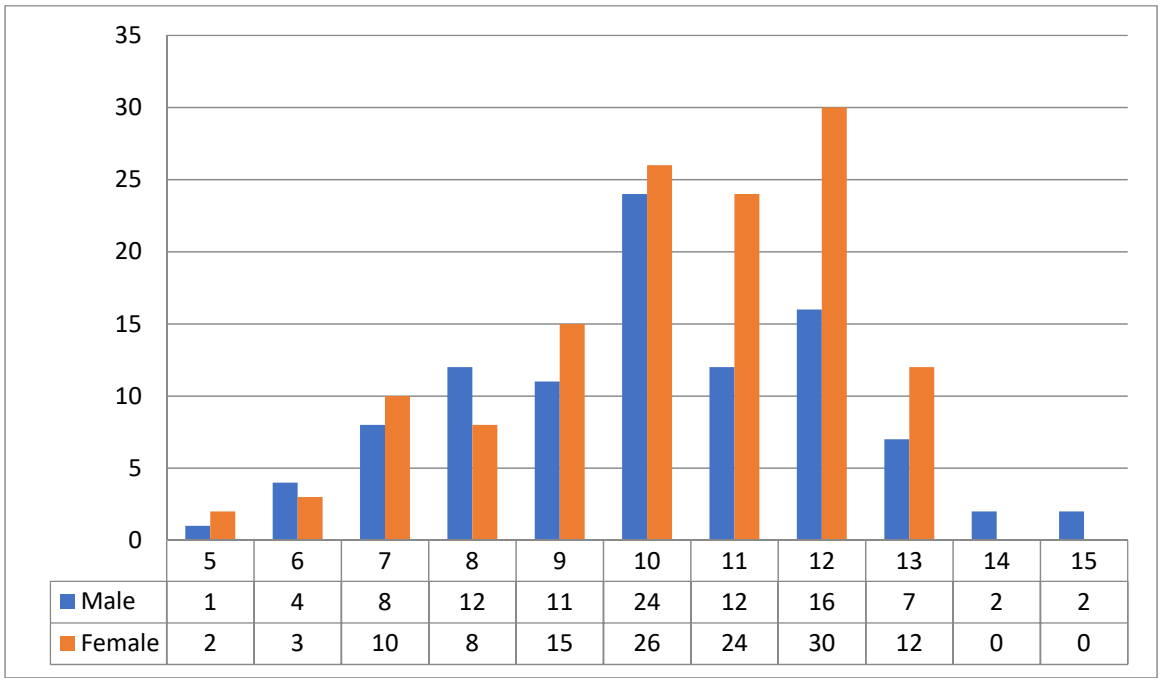
Grade	**Taiwan**	**Nigeria**
Grade 7	98	8
Grade 8	0	114
Grade 9	0	107
Total	**98**	**229**
Sex		
Male	43	99
Female	55	130
Total	**98**	**229**
Age		
11	0	50
12	6	114
13	69	48
14	22	12
15	0	3
16	0	2
Total	**98**	**229**

5.1 Descriptive Analysis

The demographic section of the questionnaire collected the participants' thoughts, experience, and opinion on humanoid robots. I wanted to find out their experience level with humanoid robots, how they got to know about the humanoids and what they think or feel about them. Descriptive statistics was performed on the responses of demographical items as well as Part 3 which consists of the humanoid selection from pictures and video clips.

5.1.1 Nigeria.

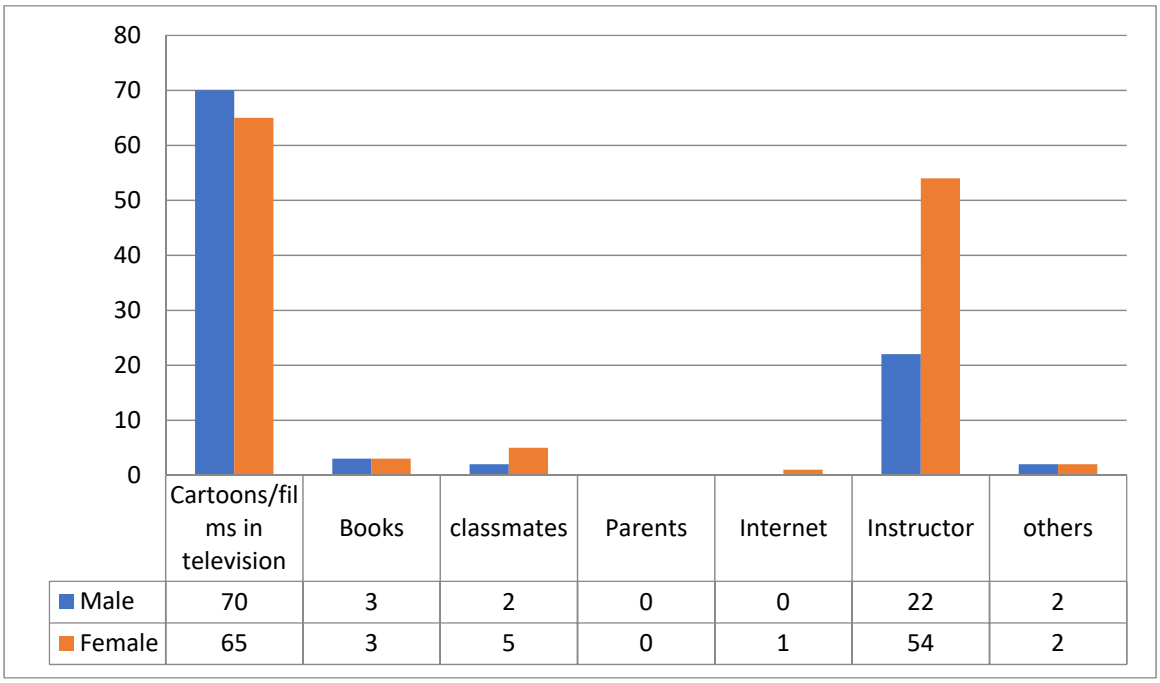
5.1.1.1 ***Demographics.*** In the analysis of "age that I knew about humanoid robots", as seen in Figure 4, the highest number of students got to know about humanoid robots at the age of 12 years followed by 10 years. In both cases, a higher number of female students got to know about humanoid robots than male students. As can be seen from the chart, there are a lot of similarities between the male and female students. Both Male and female students first got to know about humanoid robots at the age of 5 years. Apart from ages 6, 8, 14 and 15, more female students got to know about humanoid robots than their counterparts at all the other age brackets. Male and female students do not differ in the age they got to know about humanoid robots, their gender seems to have no impact on the age they learnt about humanoid robots.



	5	6	7	8	9	10	11	12	13	14	15
Male	1	4	8	12	11	24	12	16	7	2	2
Female	2	3	10	8	15	26	24	30	12	0	0

Figure 4. Chart-age that I knew of humanoid robots

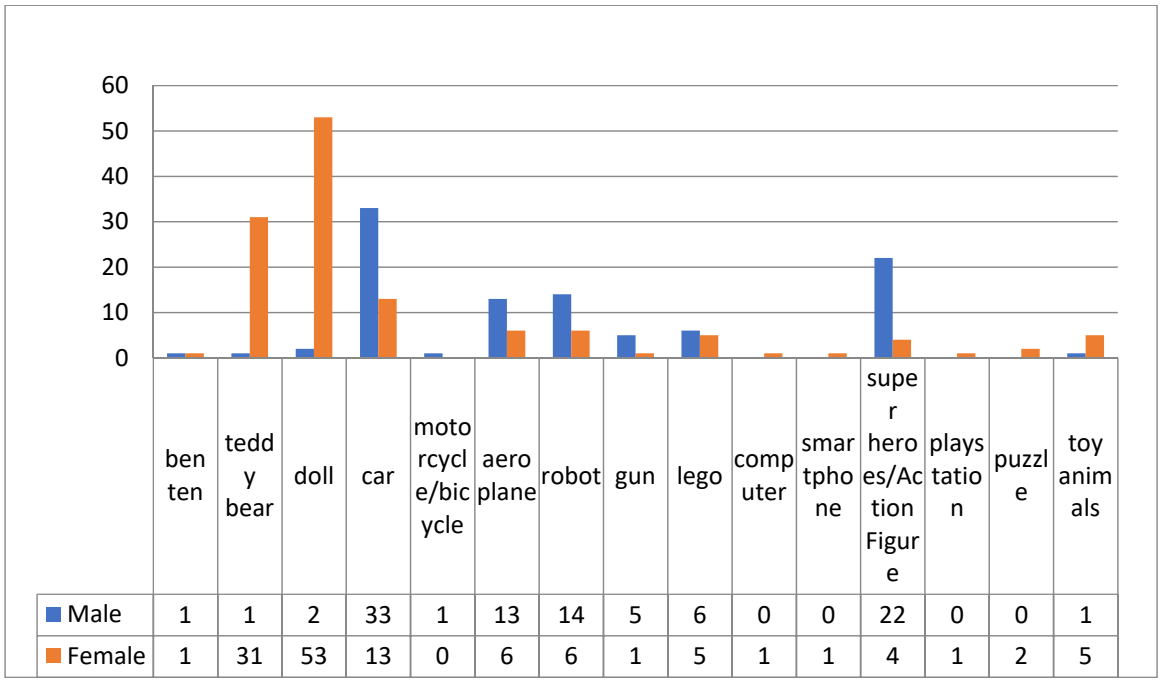
In the analysis of "common way I got information about humanoid robots", we can see that the most common source of information about the humanoid robots for both the male and female students are cartoons and films, followed by the Instructor. A higher number of male students got information from television than the female students. From this result we can see that both male and female students seem to have the same source of information about humanoids and we can conclude that their gender does not have impact on their source of information.



	Cartoons/films in television	Books	classmates	Parents	Internet	Instructor	others
Male	70	3	2	0	0	22	2
Female	65	3	5	0	1	54	2

Figure 5. Chart "way I got information about humanoid robots"

In the analysis of "the toy I like most", as seen in Figure 6, a higher number of the students like other toys than the humanoid robots – in fact, only 20 out of 229 students explicitly say they like robot. Be worth to mention, female students also like teddy bears followed by cars. On the other hand, male students' favorite toy is car followed by Super Heroes and then Robots. Both male and female students like humanoid robots. It is their fifth overall choice of toy. The choice of toys differs in both male and female students, meaning that their gender plays a big role in their choice of toys. *H5 is Confirmed*.



	ben ten	teddy bear	doll	car	motorcycle/bicycle	aeroplane	robot	gun	lego	computer	smartphone	super heroes/Action Figure	playstation	puzzle	toy animals
Male	1	1	2	33	1	13	14	5	6	0	0	22	0	0	1
Female	1	31	53	13	0	6	6	1	5	1	1	4	1	2	5

Figure 6. Bar Chart "the toy I like most"

5.1.1.2 ***Pictures and Videos.*** Descriptive analysis was also performed ion students' preferences through choosing pictures and videos of humanoid robots. The results can be seen in the bar charts below. From Figure 7, we can see that the female humanoids were liked best. A higher number of male students like male humanoids while female students like female humanoids and equal number of male and female students like child humanoids best. We can conclude that the gender of the students impacts their humanoid robot gender preference. This result confirms H5A. The result will be discussed later.

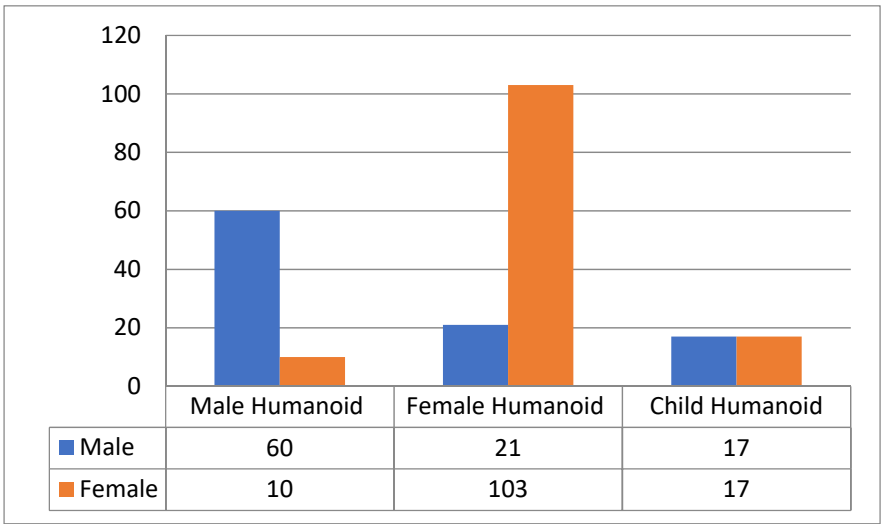


Figure 7. Bar Chart "the picture I like best"

From Figure 8, we can see that female humanoid robots were liked best. Male students like male humanoids while female students like female humanoids best, they also like child humanoids. The video result also shows that the gender of the students has impact on their humanoid robot gender preference. This *result confirms H5A*. The result will be discussed later.

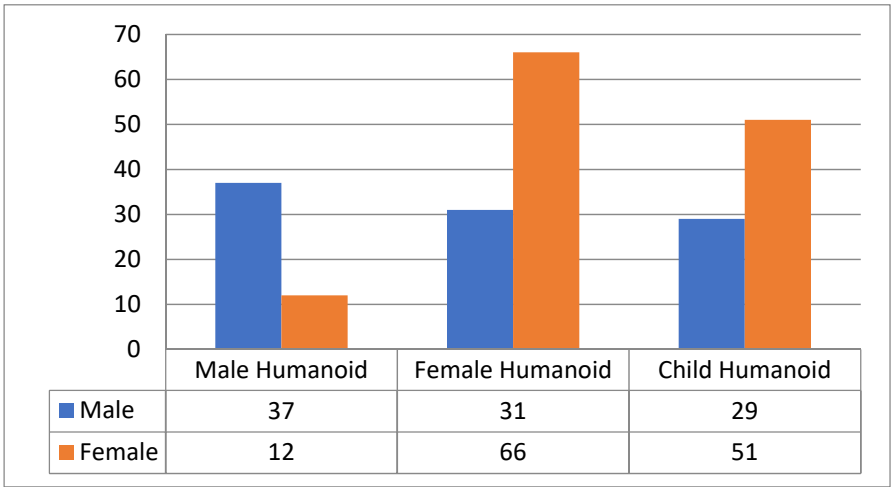


Figure 8. Bar Chart "the Video I like best"

5.1.1.3 ***Size (Comments).*** Size is very important in humanoid robot's appearance. Two robot sizes, Large (adult) and Mini (child-like) sized humanoid robots

were considered in this study. Figures 9 & 11 show the analysis results for these two groups. There are similarities in the type of humanoid robots that female and male students like. Figure 9 shows that 35.4% of the male students believe that bigger humanoid robots are better than smaller ones, 35 out of 99 male students agree bigger robots are better compared to 42 students who agree smaller robots are better. Around 45.5% of male students (24 and 21 students expressed Neural feeling for the two comparison statements) have no preference and 40.4% (40 out of 99) feel that smaller humanoids are better. On the other hand, 36.2% (47 out of 130) of female students agree bigger humanoid robots are better, 36.2% (24 and 23 students expressed Neural feeling for the two comparison statements) have no preference and 45.4% (59 out of 130) feel smaller humanoids are better.

Overall, a higher number of both male and female students feel that smaller humanoid robots are better than larger ones. Their gender does not seem to have impact on the size of humanoid robots they prefer. *H3 is rejected*. The result will be discussed later.

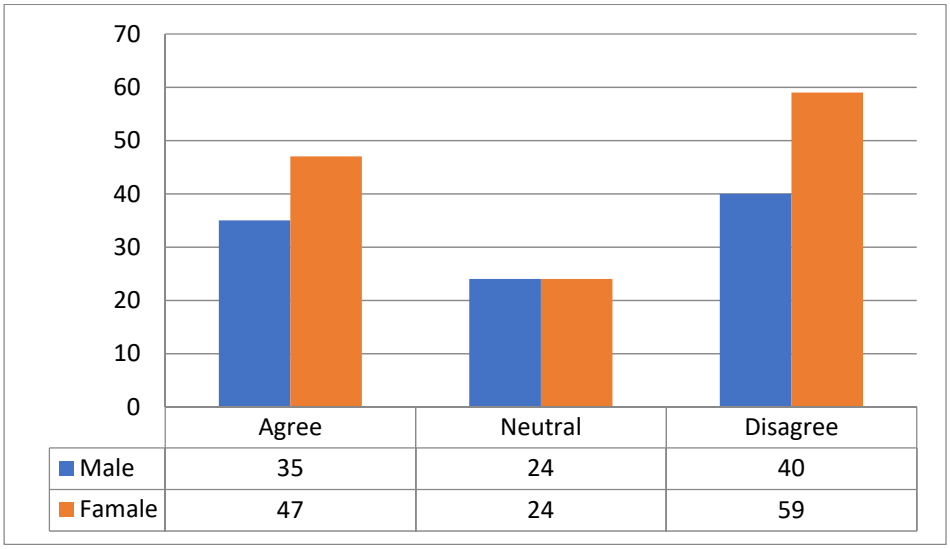
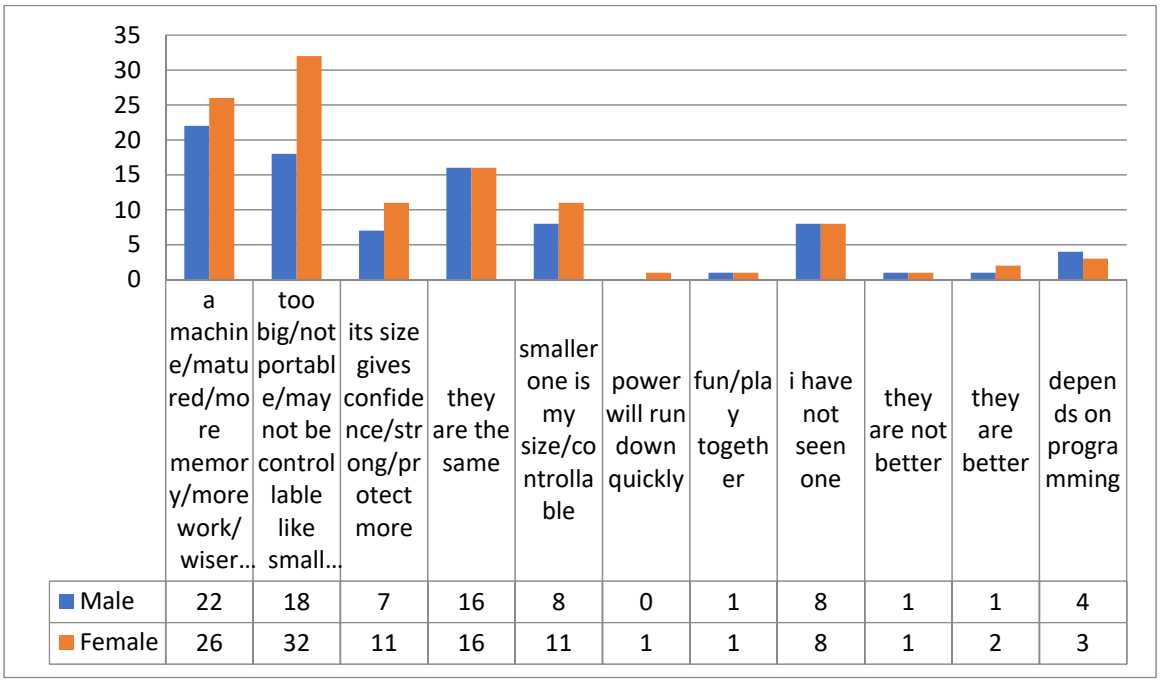


Figure 9. Chart Likert-scale of "larger humanoids are better"

The analysis was also performed on the comments part of the Size items. Figures 10 & 12 show the results for the comments. As can be seen from Figure 10, the large body

and bigness of male humanoid robots makes it scary and fearful to students. This explains why both male and female students prefer smaller humanoid robots to larger ones.



	a machine/matured/more memory/more work/ wiser...	too big/not portable/may not be controllable like small...	its size gives confidence/strong/protect more	they are the same	smaller one is my size/controllable	power will run down quickly	fun/play together	i have not seen one	they are not better	they are better	depends on programming
Male	22	18	7	16	8	0	1	8	1	1	4
Female	26	32	11	16	11	1	1	8	1	2	3

Figure 10. Chart Comments “larger humanoids are better”

Figure 11 shows that 42.4% of the male students believe that smaller humanoid robots are better than larger ones, 42 out of 99 male students agree smaller robots are better compared to 35 students who agree larger robots are better. Around 45.5% of male students (24 and 21 students expressed Neural feeling for the two comparison statements) have no preference and 36.4% (36 out of 99) feel that larger humanoids are better. On the other hand, 53.1% (69 out of 130) of female students agree smaller humanoid robots are better, 36.2% (24 and 23 students expressed Neural feeling for the two comparison statements) have no preference and 29.2% (38 out of 130) feel larger humanoids are better. As can be seen this result tallies with the result in Figure 9.

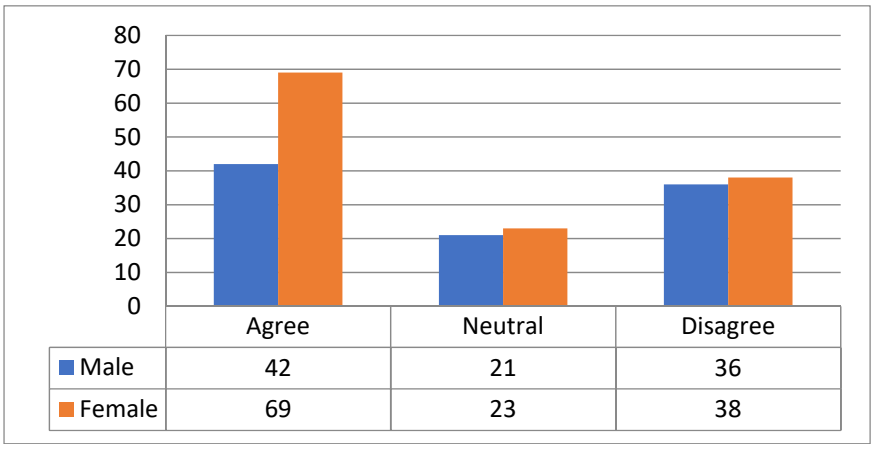


Figure 11. Chart Likert-scale of "smaller humanoids are better"

In Figure 12, the portability, cuteness and size of smaller humanoid robots is responsible for some students' preference for smaller humanoid robots.

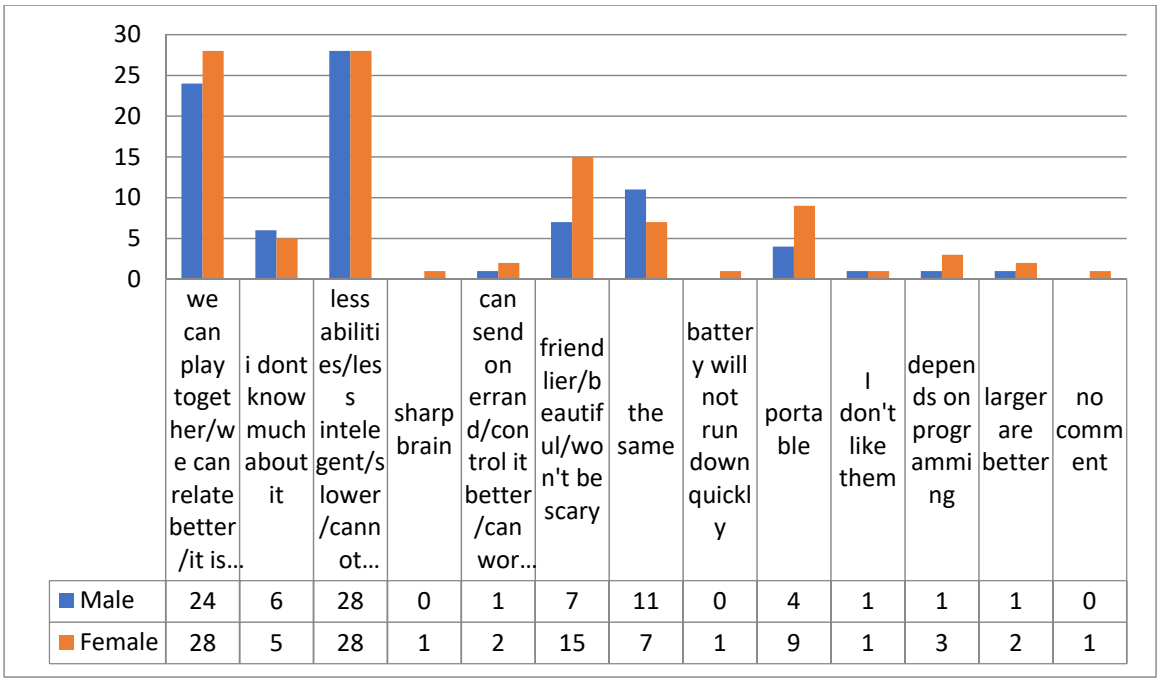


Figure 12. Bar Chart "smaller humanoids are better" Comments

5.1.1.4 ***Function & Opinion.*** Items 4 & 5 were analyzed to answer the research question: Do male students and female students have different perception of

humanoid robot and their roles? It will prove the hypotheses below:

H4A: Female students' opinion of humanoid robots is different from that of male students

H4B: Female students' perception of humanoid robots' role is different from that of male students

H4B1: Female students wish to have humanoid robots as helpers in class while male students don't

These analyses tests for the students' perceived functions and opinions toward humanoid robots. Table 22 & 23 show the results of the Crosstab analyses for items 4 and 5. From Table 22 and Figure 13, we observe that both male and female students would like to have humanoid robots as friends. The female students will then like humanoid robots to assist with house chores and then to teach. The function of teaching is the second option for male students and assisting with house chores is the third option.

Table 22. Crosstab Analysis Function Preference (item 4)-Nigeria

Item	Count	Gender		
		Boy	Girl	Total
If I had a humanoid robot, I would want it to (4a, b & c)	Work/help	33	45	78
	friend	61	87	148
	teach	53	64	117
	guard	34	20	54
	house work	43	77	120
	driver	11	18	29
	fish	0	0	0
	female	3	9	12
	male	8	0	8
	transform	4	5	9
	fly	6	16	22
	beautiful	1	1	2
	I don't want	0	0	0
Total		257	342	599

Overall, these results show that there are great similarities in the function preference of both male and female students for humanoid robots. Their gender does not seem to have an impact on the functions they would want humanoid robots to perform. *H4B & H4B1 are rejected*. The result will be discussed later.

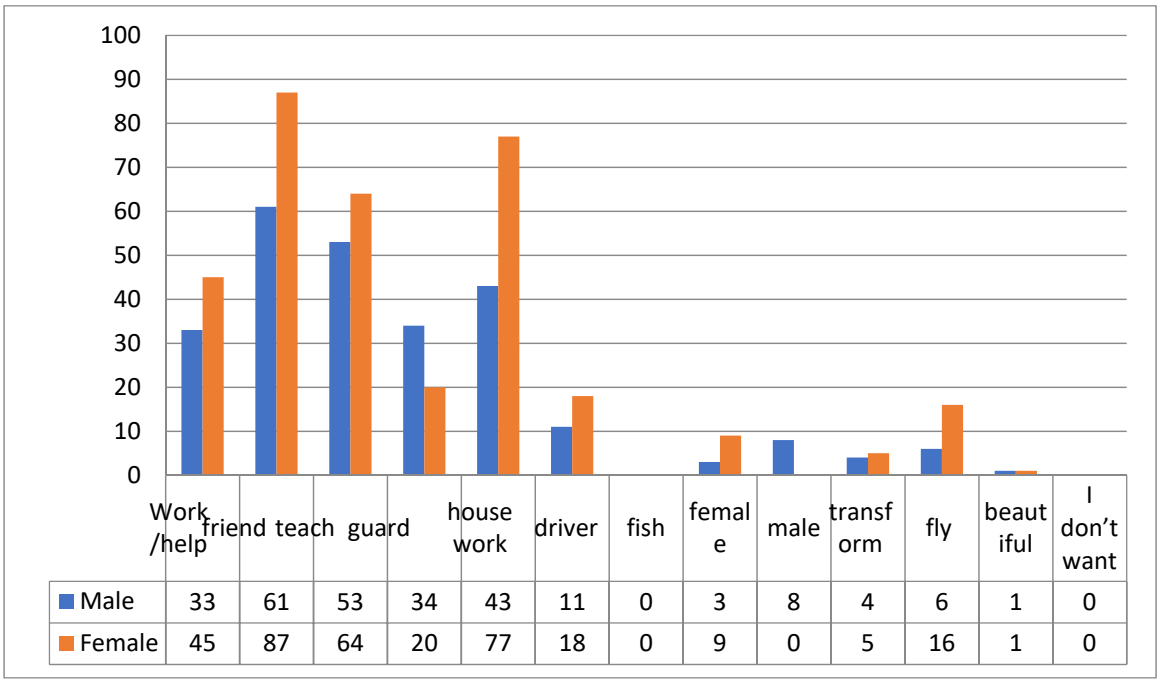
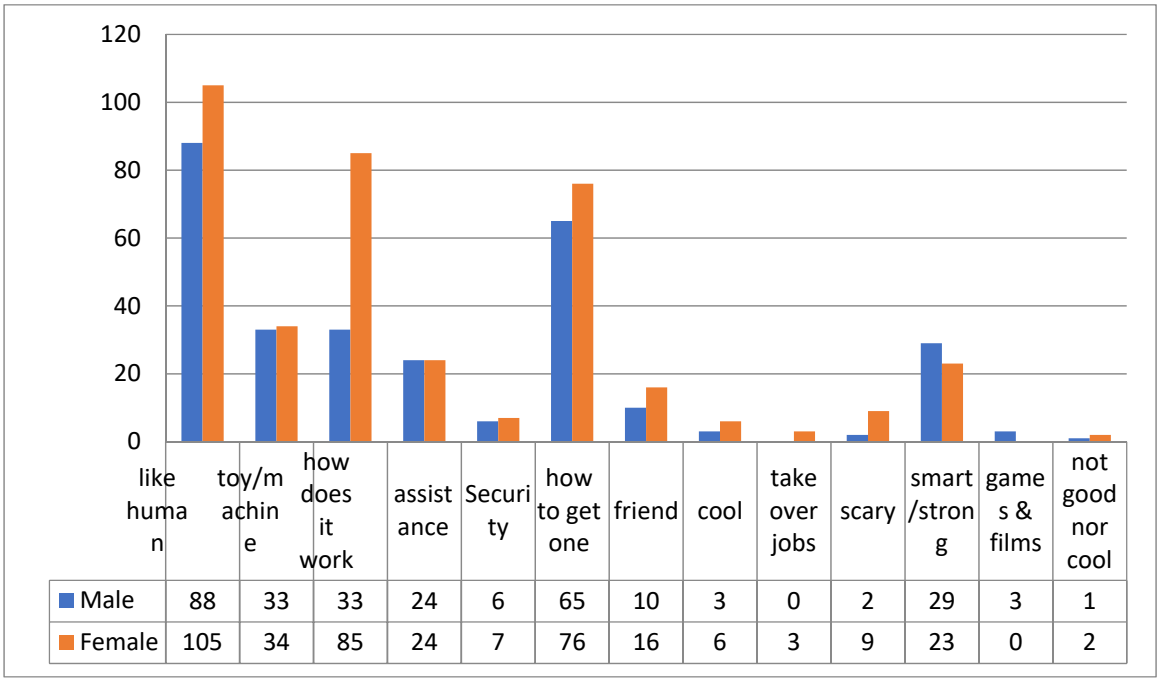


Figure 13. Bar Chart on Function (Item 4) Preference

In Table 23 and Figure 14, both male and female student' think that humanoid robots are like human. The female students' second opinion is that they would like to know how humanoid robots work and how to obtain one. On the other hand, male students' second thought is on how to get one and knowing how it works.

Table 23. Crosstab Analysis on Opinion (item 5) – Nigeria

Item	Count	Gender		
		Boy	Girl	Total
When someone talks about humanoid robot, the following ideas comes to my mind (5a, b & c)	like human	88	105	193
	toy/machine	33	34	67
	how does it work	33	85	118
	assistance	24	24	48
	Security	6	7	13
	how to get one	65	76	141
	friend	10	16	26
	cool	3	6	9
	take over jobs	0	3	3
	scary	2	9	11
	smart/strong	29	23	52
	games & films	3	0	3
	not good nor cool	1	2	3
Total		297	390	687



	like human	toy/machine	how does it work	assistance	Security	how to get one	friend	cool	take over jobs	scary	smart/strong	games & films	not good nor cool
Male	88	33	33	24	6	65	10	3	0	2	29	3	1
Female	105	34	85	24	7	76	16	6	3	9	23	0	2

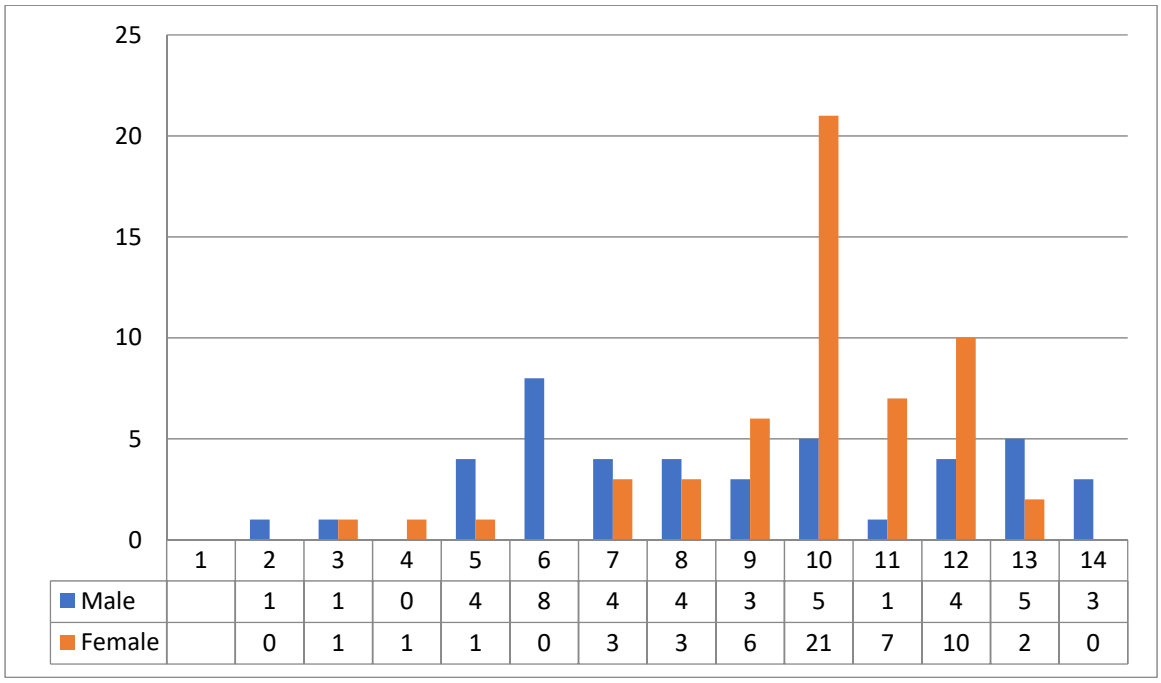
Figure 14. Bar Chart on Opinion (item 5)

Overall, these results show that there are great similarities in male and female students' opinion about humanoid robots. The students' gender does not seem to have impact on their opinion of humanoid robots. *H4A is rejected*. The result will be discussed later.

5.1.2 Taiwan.

5.1.2.1 ***Demographics.*** Figure 15 shows, most of the students learnt about humanoid robot at the age of 10 years followed by 12 years. In both cases, more female students learnt about humanoid robots than male students. As can be seen from the chart, there are similarities between the male and female students. Male students learnt about humanoid robots when they were about 2 years old, while female students learnt about humanoid robots at the age of 3. Between the ages of 2 and 8 more males learned about humanoids, while more females learnt about humanoid robots between the ages of 9 and 12. As can be seen from the result, male and female students are similar in the age they learnt about humanoid robots, their gender seems to have no impact on the

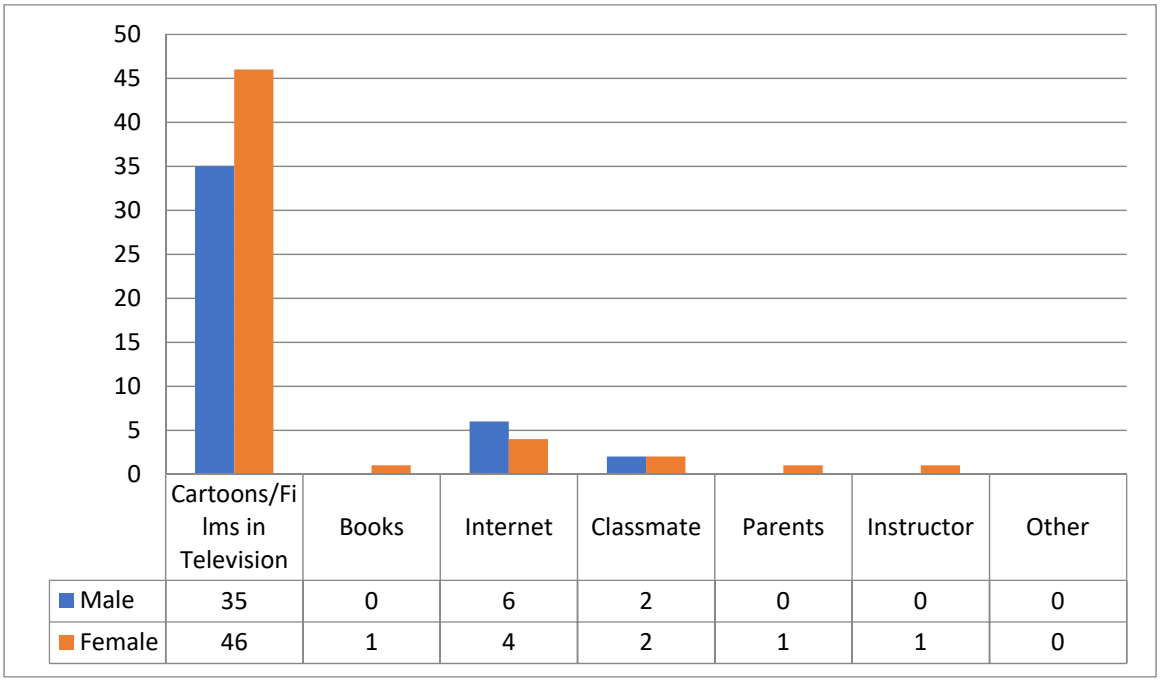
age they learned about humanoid robots.



	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Male		1	1	0	4	8	4	4	3	5	1	4	5	3
Female		0	1	1	1	0	3	3	6	21	7	10	2	0

Figure 15. Chart– “age that I knew about humanoid robots”

From Figure 16, we can see that the most common source of information about the humanoid robots for both the male and female students is cartoons and films, followed by the Internet. A higher number of female students got information from television than the male students. From this result we can see that both male and female students seem to have the same source of information about humanoids and we can conclude that their gender does not impact their source of information.



	Cartoons/Films in Television	Books	Internet	Classmate	Parents	Instructor	Other
Male	35	0	6	2	0	0	0
Female	46	1	4	2	1	1	0

Figure 16. Chart "source of information on humanoid robots"

As seen in Figure 17, most female students like dolls. Moreover, a higher number of the students like other toys than the humanoid robots – in fact, only two students explicitly say they like robot. It should be noted that female students also like smart phones. On the other hand, male students' favorite toy is car followed by Lego. Both male and female students like humanoid robots, though it is one of their least favorable toys, suggesting that they do not see humanoid robots as toys. We can infer from this result that the preferred choice of toy differs in both male and female students, meaning that gender plays a big role in the choice of toys. *H5 is Confirmed*.

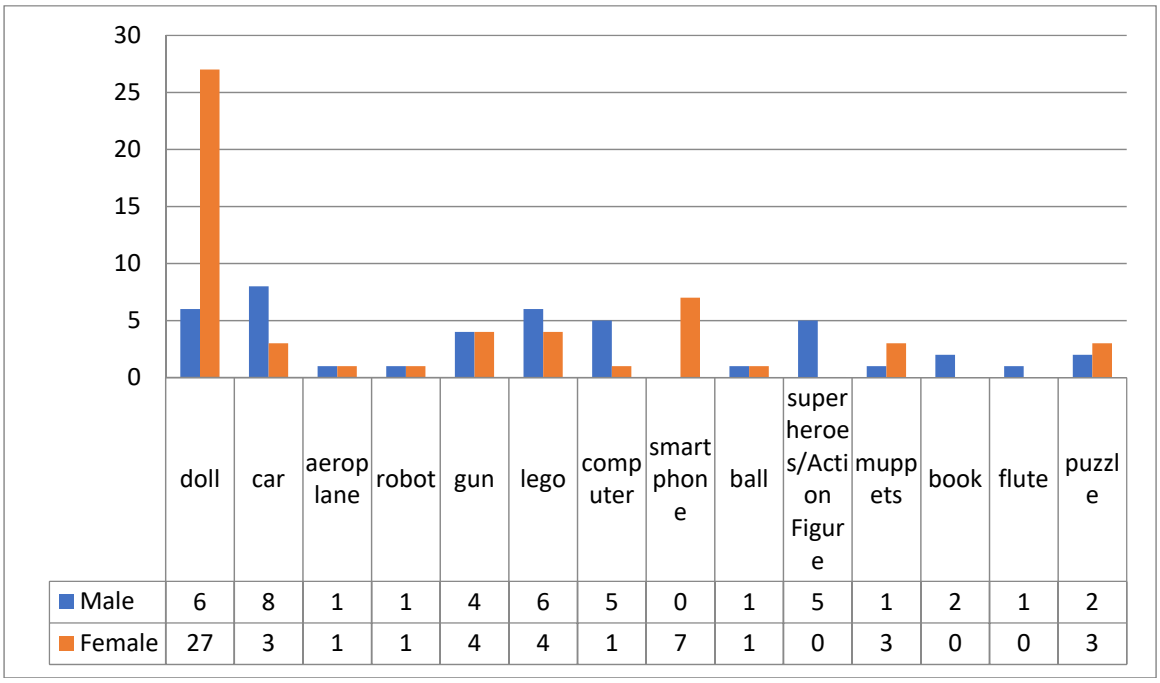


Figure 17. Bar Chart "the toy I like most"

5.1.2.2 ***Pictures and Videos.*** Descriptive analysis was also performed on students' preferences through choosing pictures and videos of humanoid robots. The results can be seen in the bar charts below.

From Figure 18, we can see that the male humanoids were liked most. More male students like male humanoids while more female students like both female humanoids and child humanoids best. This result can also be explained with the fact that dolls (baby dolls and Barbie) are female students' favorite toy. We can conclude that the students' gender impacts their humanoid robot gender preference. This *result confirms H5A*. The result will be discussed later.

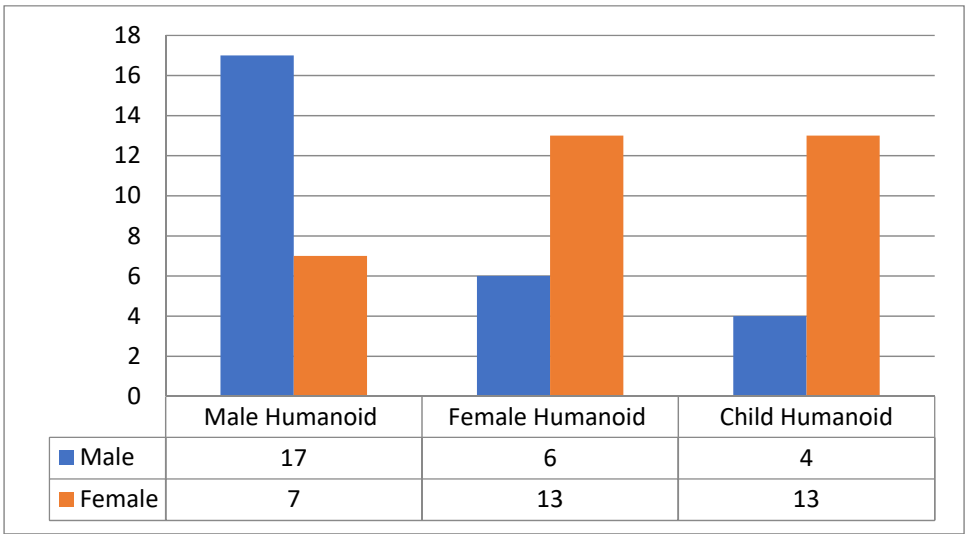


Figure 18. Bar Chart "the picture I like best"

From Figure 19, we can see that Child humanoid robots were liked most. A higher number of male students like male humanoids while female students like child humanoids most, they also like female humanoids. This also shows that the gender of the students has impact on their humanoid robot gender preference. This *result confirms H5A*. The result will be discussed later.

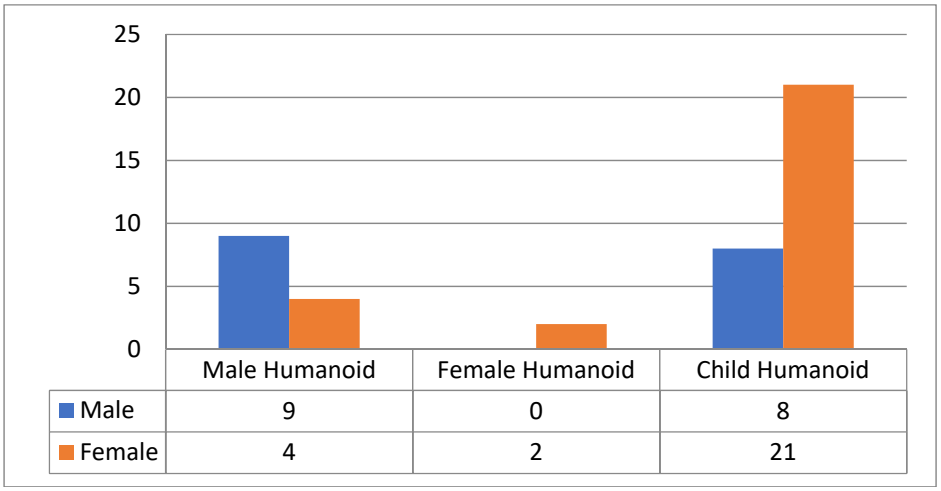


Figure 19. Bar Chart "the Video I like best"

5.1.2.3 ***Size (Comments).*** Two robot sizes, Large (adult) and Mini (child-like) size humanoid robots were also used in this study. Figures 20 & 21 show the analysis results for these two groups. There are similarities in the type of humanoid robots that female and male students like. 49% of the male students believe that bigger humanoid robots are better than smaller ones, 21 out of 43 male students agree bigger robots are better compared to only 7 students who agree smaller robots are better. Around 40% of male students (18 and 16 students expressed Neural feeling for the two comparison statements) have no preference and 9% (7 out of 43) feel that smaller humanoids are better. On the other hand, 44% (24 out of 55) of female students agree bigger humanoid robots are better, 27% (15 and 15 students expressed Neural feeling for the two comparison statements) have no preference and 29% (18 out of 55) feel smaller humanoids are better. Overall, a higher number of both male and female students feel that larger humanoid robots are better than smaller ones. Their gender does not seem to have impact on the size of humanoid robots they prefer. H3 is rejected. The result will be discussed later.

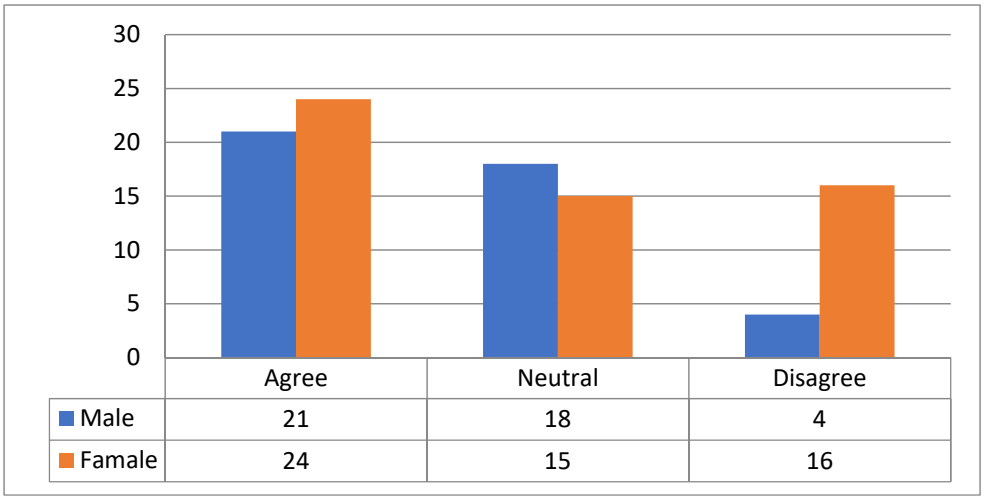
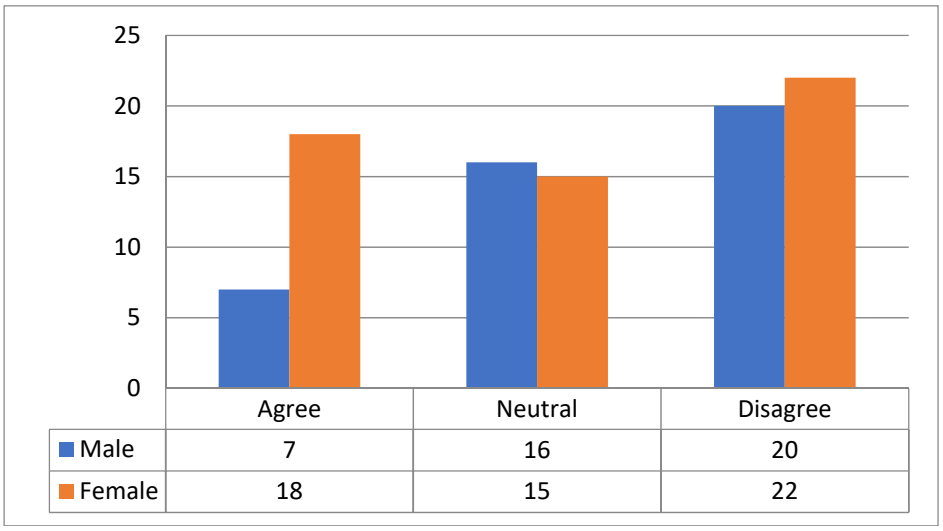


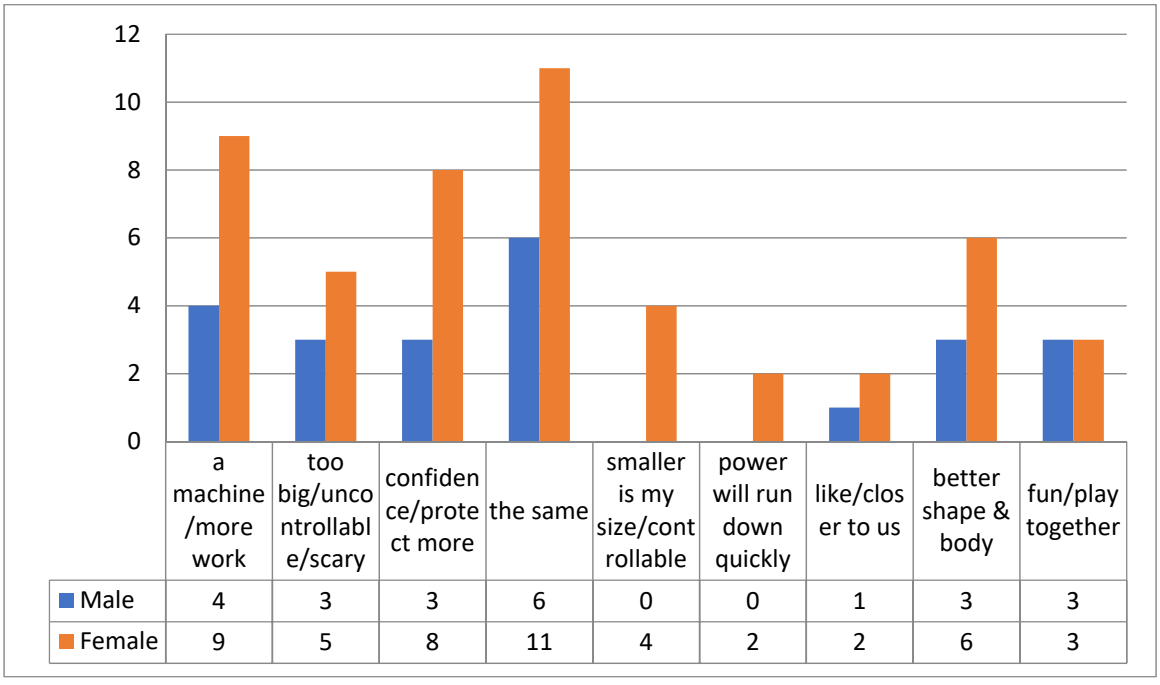
Figure 20. Chart Likert-scale of "larger humanoids are better"



	Agree	Neutral	Disagree
Male	7	16	20
Female	18	15	22

Figure 21. Chart Likert-scale of "smaller humanoids are better"

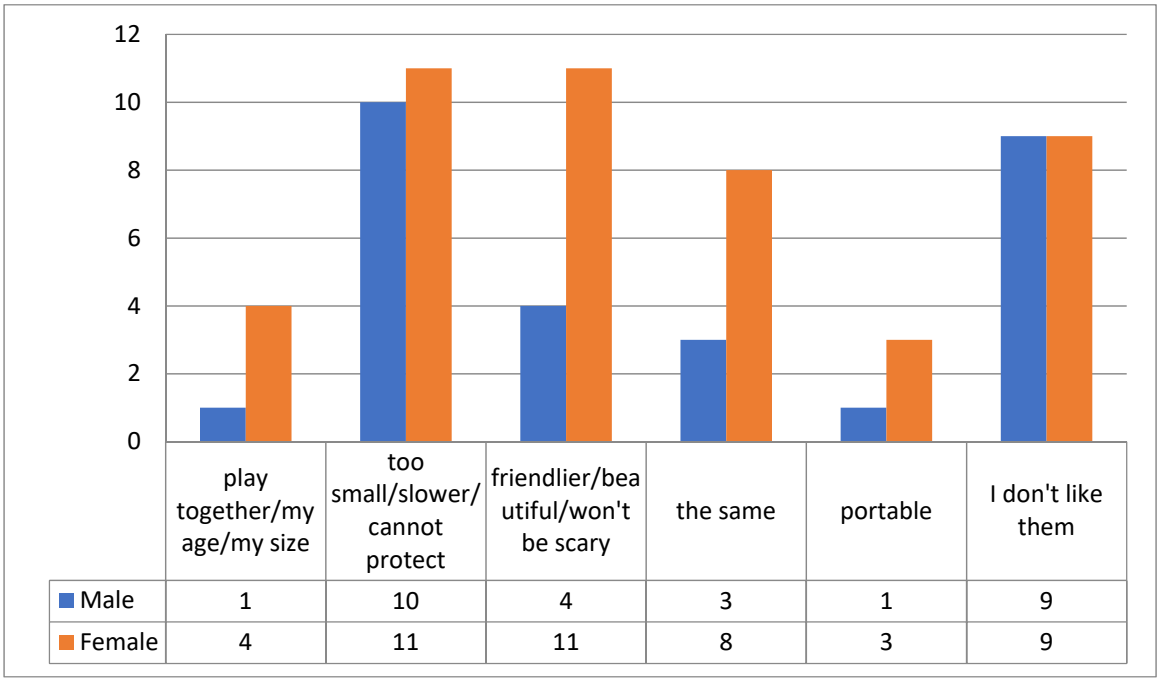
The result of the analysis performed on the comments part of the Size items is shown in Figures 22 & 23. As can be seen from Figure 22, the large body and strength of male humanoid robots which gives it ability to protect and do more work are the reasons why it is the preferred choice of humanoid robot.



	a machine /more work	too big/uncontrollable/scary	confidence/protect more	the same	smaller is my size/controllable	power will run down quickly	like/closer to us	better shape & body	fun/play together
Male	4	3	3	6	0	0	1	3	3
Female	9	5	8	11	4	2	2	6	3

Figure 22. Chart "larger humanoids are better" Comments

While Figure 23 shows that the smallness of the humanoid robot is reason for its choice preference. Some students prefer it because it is not scary to them like the large one is, others like it because they can play with it. On the other hand, some students prefer larger humanoids because they think smaller one will be too slow and will not be able to protect and defend them. Over all more students prefer the larger size for its strength.



	play together/my age/my size	too small/slower/ cannot protect	friendlier/beautiful/won't be scary	the same	portable	I don't like them
Male	1	10	4	3	1	9
Female	4	11	11	8	3	9

Figure 23. Chart "smaller humanoids are better" Comments

5.1.2.4 ***Function & Opinion.*** To test for students' opinion about humanoid functions and roles, items 4 & 5 were analyzed using crosstab analyses. These tests will attempt to answer the research question: Do male students and female students have different perception of humanoid robot and their roles? It will prove the hypotheses below:

H4A: Female students' opinion of humanoid robots is different from that of male students

H4B: Female students' perception of humanoid robots' role is different from that of male students

Table 24 and Figure 24 show the result of the Crosstab analysis for items 4. As seen from the table, both male and female students would like to have humanoid robots assisting with house chores. The female students will also like to be friends with humanoid robots and finally they will have them to assist and help with difficult tasks. The male students' second option is for humanoid robots to assist with difficult work and finally to teach.

Table 24. Crosstab Analysis Function Preference (item 4) – Taiwan

Item	Count	Gender		Total
		Boy	Girl	
If I had a humanoid robot, I would want it to (4a, b & c)	Work/help	14	22	36
	friend	9	27	36
	teach	13	20	33
	guard	9	7	16
	house work	23	43	66
	driver	4	3	7
	female	0	0	0
	male	0	0	0
	transform	0	0	0
	fly	0	0	0
	beautiful	0	0	0
	fish	2	0	2
	I don't want	4	3	7
Total		78	125	203

The result shows that there are great similarities in the role or function that both male and female students have for humanoid robots. Their gender does not seem to have an impact on the role or function they presume humanoid robots should have. *H4B & H4B1 are rejected*. The result will be discussed later.

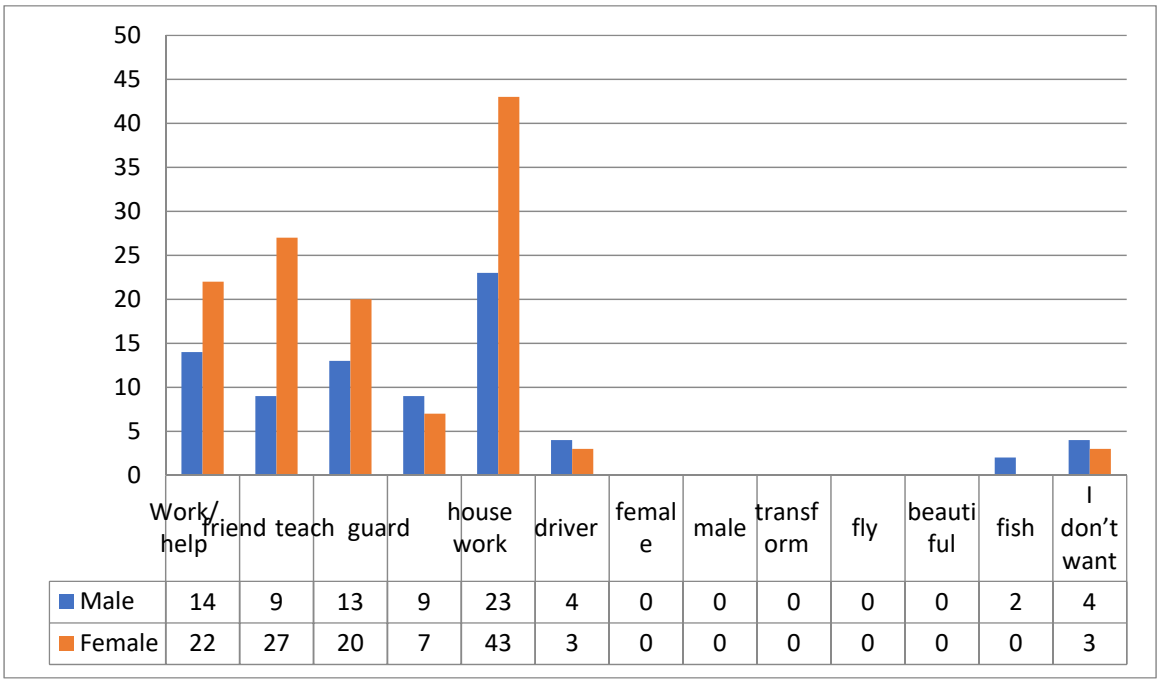


Figure 24. Bar Chart on Function (Item 4) Preference

As seen from the crosstab analysis in Table 25 and Figure 25, male students think that humanoid robots are smart and very strong, their second opinion is that they are like human and thirdly that they are cool. On the other hand, female students have the opinion that humanoid robots are cool, their second opinion is that they are smart and strong and finally that they are scary.

Table 25. Crosstab Analysis Function Preference (item 5) - Taiwan

Item	Count	Gender		
		Boy	Girl	Total
When someone talks about humanoid robot, the following ideas comes to my mind (5a, b, c)	like human	14	12	26
	toy/machine	8	11	19
	how does it work	9	6	15
		9	8	17
	assistance	2	2	4
	Security	2	4	6
	how to get one	1	0	1
	friend	13	16	29
	cool	1	2	3
	take over jobs	3	13	16
	scary	17	15	32
	smart/strong	7	5	12
	games & films	3	6	9
	not good nor cool			
Total		89	100	189

Overall, these results show that there are some similarities in the opinion that both male and female students have about humanoid robots. The students' gender does not have impact on their opinion about humanoid robots. *H4A & H4A1 are rejected*. The result will be discussed later.

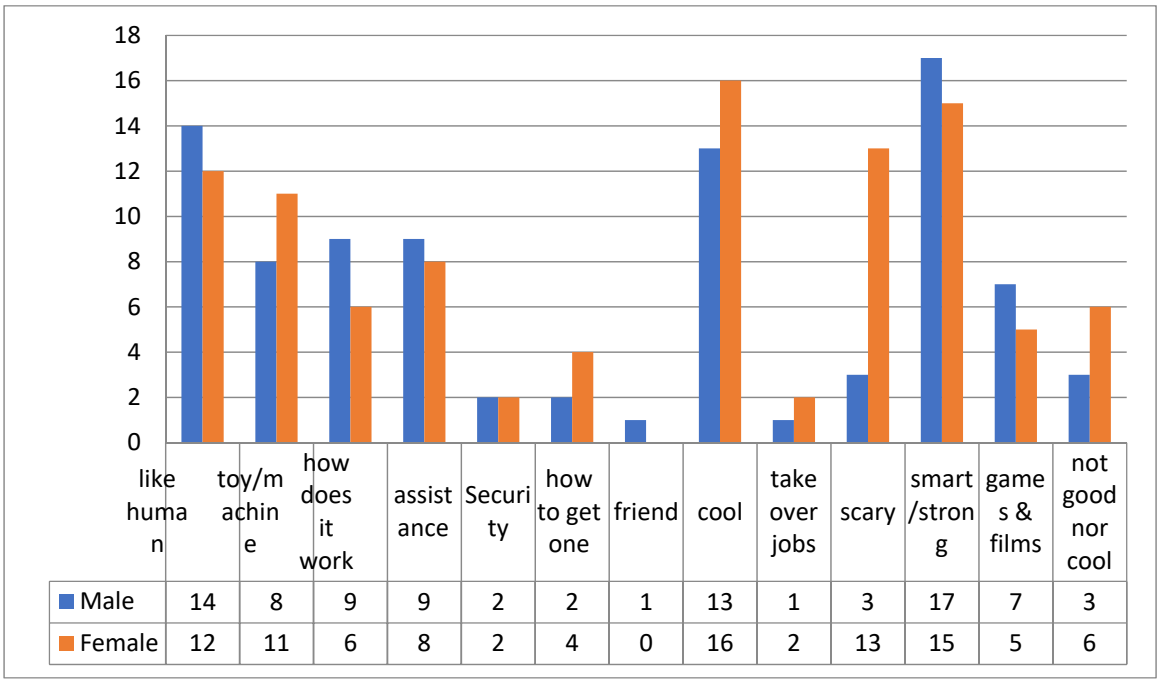


Figure 25. Bar Chart on Function (item 5) Preference

5.2 Validity and Reliability Analysis of the Final Survey

The responses from Nigeria and Taiwan were combined to form a single dataset. Cronbach's Alpha (SPSS) test was performed on the combined dataset to test its reliability. Table 26 lists the reliability analysis results. The Cronbach's alpha value for the Gender and Attitude factors are both 0.797, indicating that the items of these factors are reliable. The Cronbach's alpha value for the Role factor is 0.565 which is poor; this indicates that the factor is not reliable. The alpha value increases to a poor but acceptable value of 0.658 when item Q12 is removed.

Table 26. Cronbach's alpha of Questionnaire Combined

Factors	Item amount	Cronbach's alpha	Cronbach's alpha if Item is deleted
Gender	6	**0.797**	Q6 – 0.803 Q7 – 0.756 Q8 – 0.759 Q9 – 0.735 Q10 - 0.771 Q11 – 0.766
Role	4	**0.565**	Q12 – 0.658 Q14 – 0.345 Q15 – 0.358 Q16 – 0.522
Attitude	3	**0.797**	Q17 – 0.880 Q18 – 0.622 Q19 – 0.647

Principal Component Analysis was then conducted to assess the items' validity. Table 27 show the factor loading for each item of the Role factor. All the items apart from Q12 have high factor loading suggesting that these items are substantially related to the items in this factor while item Q12 does not relate to items of the Role factor.

Table 27. Component Analysis for Items of the Role Factor

	Component
	1
Q14	**0.834**
Q15	**0.830**
Q16	**0.605**
Q12	**0.255**

Extraction Method: Principal Component Analysis
Rotation Method: Varimax with Kaiser Normalization
Bold: item's factor loading is over 0.5 for the pre-defined component
Bold and underlined: factor loading for the component is less than 0.3

Table 28 shows that all the items of the Attitude factor have high factor loadings. This result suggests that these items are substantially related to the items in their factor group and that they measure the same thing as the other items in their factor groups.

Table 28. Component Analysis for Items of Attitude Factor

	Component
	1
Q18	**0.909**
Q19	**0.898**
Q17	**0.726**

Extraction Method: Principal Component Analysis
Rotation Method: Varimax with Kaiser Normalization
Bold: Item's factor loading is over 0.5 for pre-defined component

Q12 will be removed from the Role factor and the questionnaire will be revised accordingly. The collected data will be analyzed further using quantitative methods in the next section.

5.3 Quantitative Data Analysis

Chi-square and t-test analyses were performed to test the students' responses for any significant association between the gender of the humanoid robots and two factors (students' gender and students' attitude towards the humanoid robots). The combined dataset was analyzed using Chi-square and Independent t-tests analyses. The hypotheses will be verified to find the answers to the research questions.

5.3.1 Chi-square test.

5.3.1.1 ***Gender Factor.*** The items of the gender factor were analyzed using chi-square analysis, the test will attempt to answer the research question: Does the gender of humanoid robots have any effect on how male students and female students accept humanoid robot? It will prove the hypotheses below:

H5A: Humanoid robot's gender has more effect on how female student will accept humanoid robots than on how male students will accept them

H5B: Female students differ from male students in their opinion that female humanoid robots are friendlier than male humanoid robots

H5C: Female students differ from male students in their opinion that female humanoid robots are more cheerful than male humanoid robots

H5D: Female students differ from male students in their preference to learn from female Humanoid robot more than male humanoid robots

H5E: Female students differ from male students in their preference to interact more with female Humanoid robot than male humanoid robots

Table 29 lists the Cross-Tabulation and the Chi-square results for the analysis of the gender items. The result show that a higher number of male and female students believe humanoid robots should be both male and female. Though male students believe that female students will be friendlier, more cheerful and they will prefer to learn from female humanoids, they will rather interact with male humanoid robots. On the other hand, female students believe that female humanoid robots will be friendlier, more cheerful and they will prefer to interact and learn from female humanoid robots.

In the test "I believe humanoid robot should be", $p < 0.05$, the result is statistically significant, and we reject the Null hypothesis that there is no significant association between the students' gender and their humanoid gender preference. $X^2(3) = 40.377^a, p < 0.05$. There is a significant association between the students' gender and their humanoid robot's gender preference. The degree of significance is: *Cramer's V = .35 – Medium effect size*. This result confirms H5A. The result will be discussed later.

In the test for "Which humanoid robot do you think will be friendlier" $p < 0.05$, the result is statistically significant; we therefore reject the Null hypothesis that there is no significant association between the students' gender and how friendly they think humanoid robot is. $X^2(3) = 30.607^a, p < 0.05$. There is in fact a significant association between the students' gender and how friendly they think humanoid robot is. The degree of significance is: *Cramer's V = .31 – Medium effect size*. This result confirms H5B. The result will be discussed later.

In the test for "Which humanoid robot do you think will be more cheerful" $p = 0.027$, the result is statistically significant; we therefore reject the Null hypothesis that there is no significant association between the students' gender and their humanoid gender preference. $X^2(3) = 9.174^a, p < 0.05$. There is in fact a significant association between the students' gender and how cheerful they think humanoid robot is. The degree

of significance is: *Cramer's V = .17 – Small effect size*. This *result confirms H5C*. The result will be discussed later.

In the test "which humanoid robot will you prefer", $p < 0.05$, the result is statistically significant, and we reject the Null hypothesis that there is no significant association between the students' gender and their humanoid robot's gender preference. $X^2(3) = 46.138^a, p \leq 0.05$. There is a significant association between the students' gender and their humanoid robot's gender preference. The degree of significance is: *Cramer's V = .38 – Medium effect size*. This *result confirms H5A*. The result will be discussed later.

In the test "Which humanoid robot would you prefer to learn from", $p > 0.05$, the result is statistically insignificant, and we accept the Null hypothesis that there is no significant association between the students' gender and the humanoid robot they will prefer to learn from. $X^2(3) = 2.232^a, p > 0.05$. This also *H5D is rejected*. The result will be discussed later.

In the test "If you were to choose, which humanoid robot will you interact", $p < 0.05$, the result is statistically significant, and we reject the Null hypothesis that there is no significant association between the students' gender and the humanoid robot they will prefer to interact with. $X^2(3) = 47.315^a, p < 0.05$. There is an association between the students' gender and the humanoid robot they will prefer to interact with. This *result confirms H5E*. The result will be discussed later.

Table 29. Crosstab & Chi-Square Analysis - Gender – Combined

Item		Male	Female	Chi - Square Test			
	Option				Value	df	Asymptotic Significance
I believe humanoid robot should be	Male (M) Female (F) Both M & F No Gender	49 17 52 24	14 42 99 30	*Pearson Chi-Square* *Likelihood Ratio* *0 cells (0.0%) have expected count less than 5*	40.377[a] 41.401	3 3	0.000 0.000
Which humanoid robot do you think will be friendlier	Male Female Both M & F No Gender	43 69 21 9	14 118 44 9	*Pearson Chi-Square* *Likelihood Ratio* *0 cells 0.0%) have expected count less than 5*	30.607[a] 31.105	3 3	0.000 0.000
Which humanoid robot do you think will be more cheerful	Male Female Both M & F No Gender	34 72 25 11	23 104 46 10	*Pearson Chi-Square* *Likelihood Ratio* *0 cells (0.0%) have expected count less than 5*	9.174[a] 9.154	3 3	0.027 0.027
Which humanoid robot will you prefer	Male Female Both M & F No Gender	61 36 36 9	25 107 43 10	*Pearson Chi-Square* *Likelihood Ratio* *0 cells (0.0%) have expected count less than 5*	46.138[a] 47.998	3 3	0.000 0.000
Which humanoid robot would you prefer to learn from	Male Female Both M & F No Gender	33 61 38 10	32 84 51 18	*Pearson Chi-Square* *Likelihood Ratio* *0 cells (0.0%) have expected count less than 5*	2.232[a] 2.232	3 3	0.526 0.526
If you were to choose, which humanoid robot will you interact	Male Female Both M & F No Gender	62 44 26 10	25 118 36 6	*Pearson Chi-Square* *Likelihood Ratio* *0 cells (0.0%) have expected count less than 5*	47.315[a] 48.297	3 3	0.000 0.000
Total							

5.3.1.2 ***t-test Analysis.*** Independent t-test analysis was performed on the responses to test male and female students' attitude towards humanoid robots and to test the students' size and type preference for humanoid robots.

5.3.1.2.1 ***Attitude.*** The Attitude factor is analyzed by testing for significant differences in male and female students' likeness for humanoid robots and their level and frequency of interaction with humanoid robots. It also tests whether there are differences in attitude of male and female students to humanoid robots. Independent t-test analysis was performed on the mean values of the combined three items of the attitude factor to prove the hypotheses below:

H1: Female students have more positive attitude towards humanoid robots than male students

H2A: Female students interact more positively with humanoid robots than male students

H2B: Female students like humanoid robots more than male students

Table 30 shows the t-test results for male and female students. In the attitude test, the result shows that there is no significant difference in female and male students' attitude towards humanoid robots. Female students (M = 1.9213, SD = 0.83617) and male students (M = 1.8070, SD = 0.66769) (t = -1.093, p = 0.275). Since p is > 0.05, we accept the NULL hypothesis and conclude that there is no statistically significant association between the gender of the students and their attitude towards humanoid robots, *H1, H2A & H2B are rejected*. It will be discussed later.

These results can also be seen in Figures 26, 27 & 28. Both male and female students will like to interact as friends with humanoid robots.

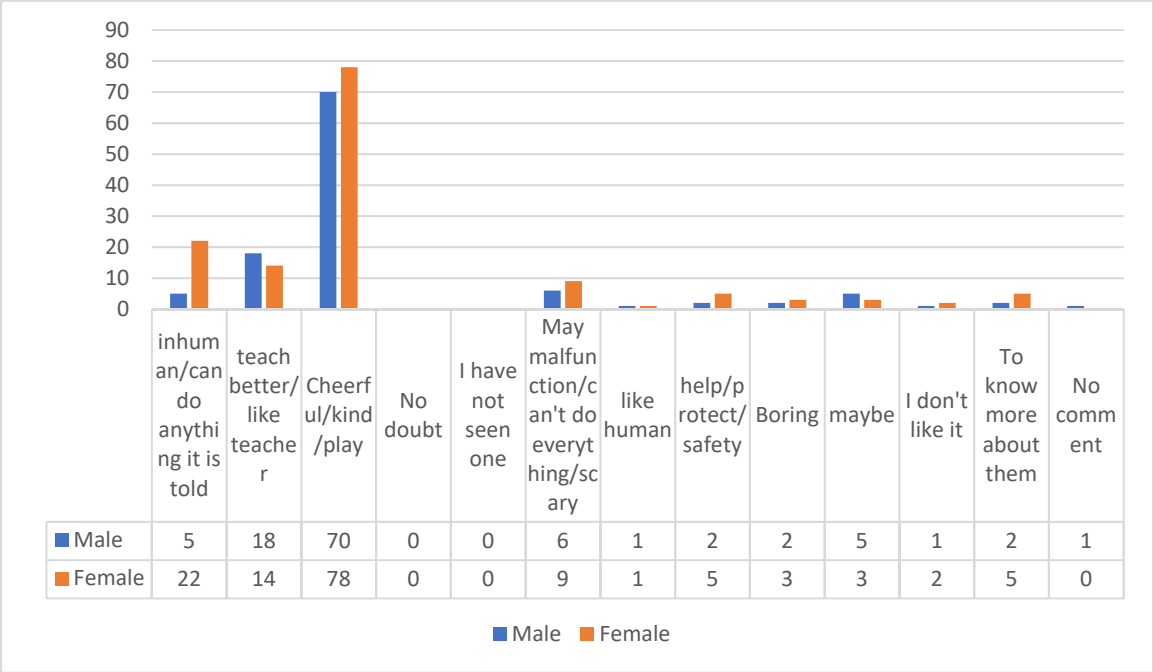


Figure 26. Chart Frequency & Descriptive test of Q17 Comment

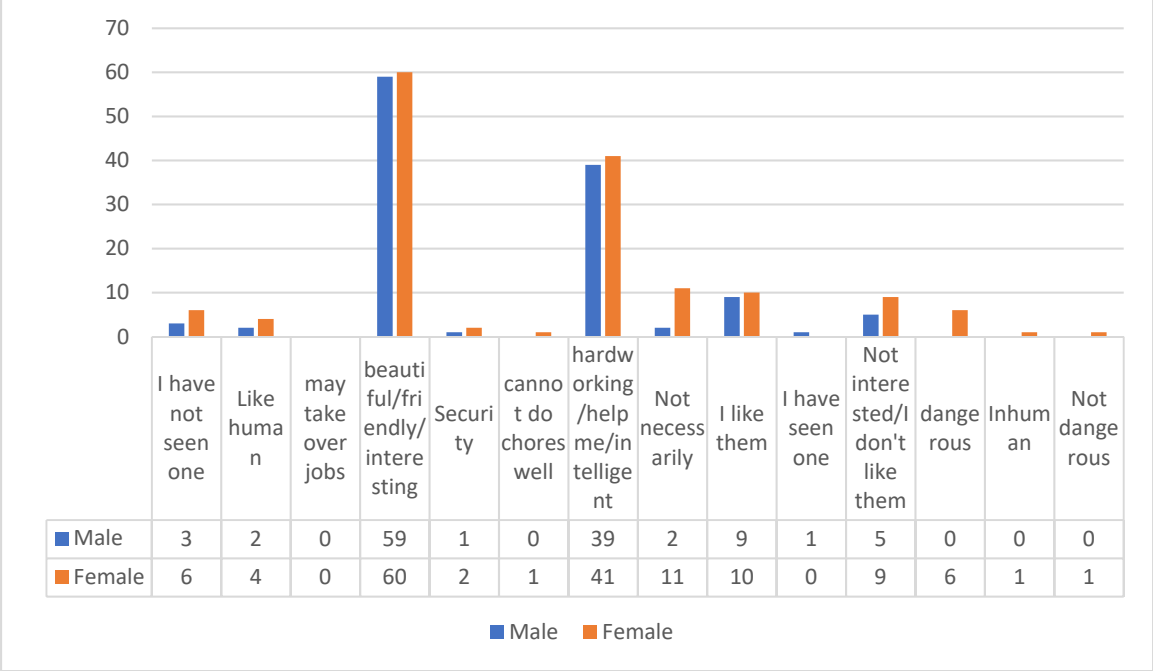


Figure 27. Chart Frequency & Descriptive test of Q19 Comment

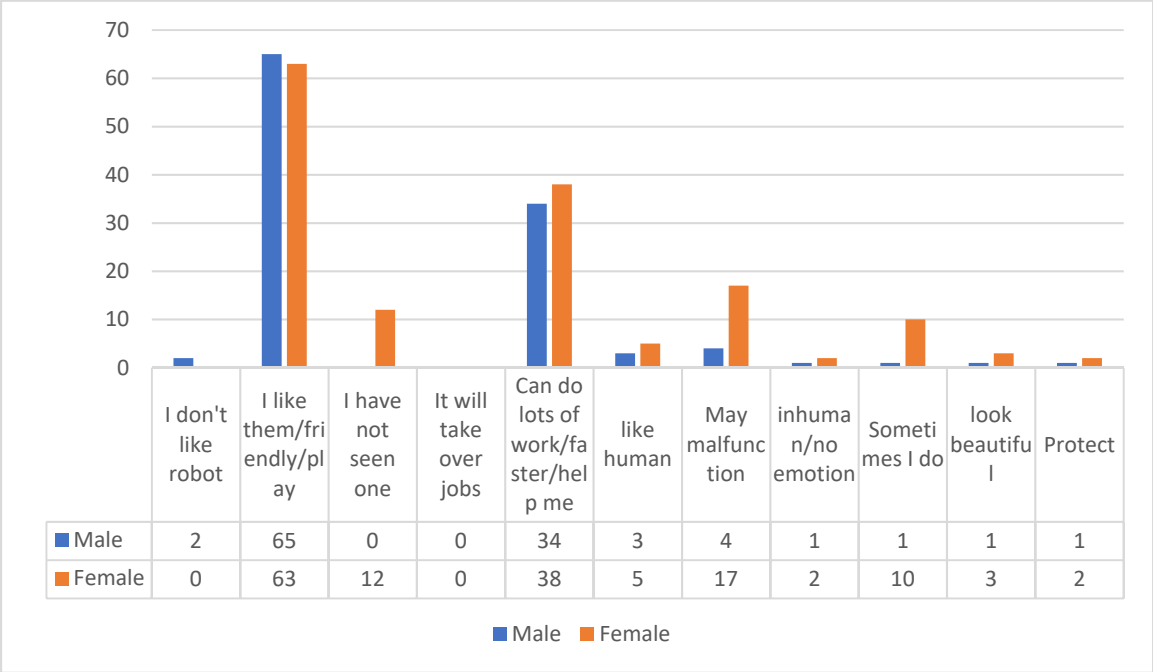


Figure 28. Chart Frequency & Descriptive test of Q18 Comment

Table 30. t-test Analysis Attitude to Humanoids – Combined

		Descriptive Statistics			t test		
		N	Mean	SD	t	df	p
Attitude	Male	95	1.8070	0.66769	-1.093	218	0.275
	Female	125	1.9213	0.83617			

5.3.1.2.2 ***Role.*** The Role factor is analyzed by testing for significant differences in male and female students' interest in learning about humanoid robots, differences in their opinion on whether they would want to have humanoid robots as tutors or teaching assistants and whether they would want to have classes teaching about humanoid robots. Independent t-test analysis was performed on the mean values of the combined four items of the role factor to prove the hypotheses below:

H4A: Female students' opinion of humanoid robots is different from that of male students

H4A1: Female students think that humanoid robots will make good tutors while male students don't

H4B: Female students' perception of humanoid robots' role is different from that of male students

H4B1: Female students wish to have humanoid robots as helpers in class while male students don't

H4C: Female students show more positive interest in humanoid robots than male students

H4D: Female students wish to learn more about humanoid robots while male students don't

Table 31 shows the t-test results for male and female students. The result of the role tests shows that there are no significant differences in female and male students' opinion of humanoid robots' role. Female students (M = 2.0740, SD = 0.59908) and male students (M = 1.9763, SD = 0.66352) (t = -1.143, p = 0.254). Since p is > 0.05, we accept the NULL hypothesis and conclude that there is no statistically significant association between the gender of the students and their opinion of what role humanoid robot should have. *H4A, H4A1, H4B, H4B1, H4C & H4D are rejected*. This will be discussed later. These results can also be seen in Figures 29, 30, 31 & 32. Both male and female students think humanoid robots will make good tutors and they will like to learn more about humanoid robots. They also both show positive interest in humanoid robots.

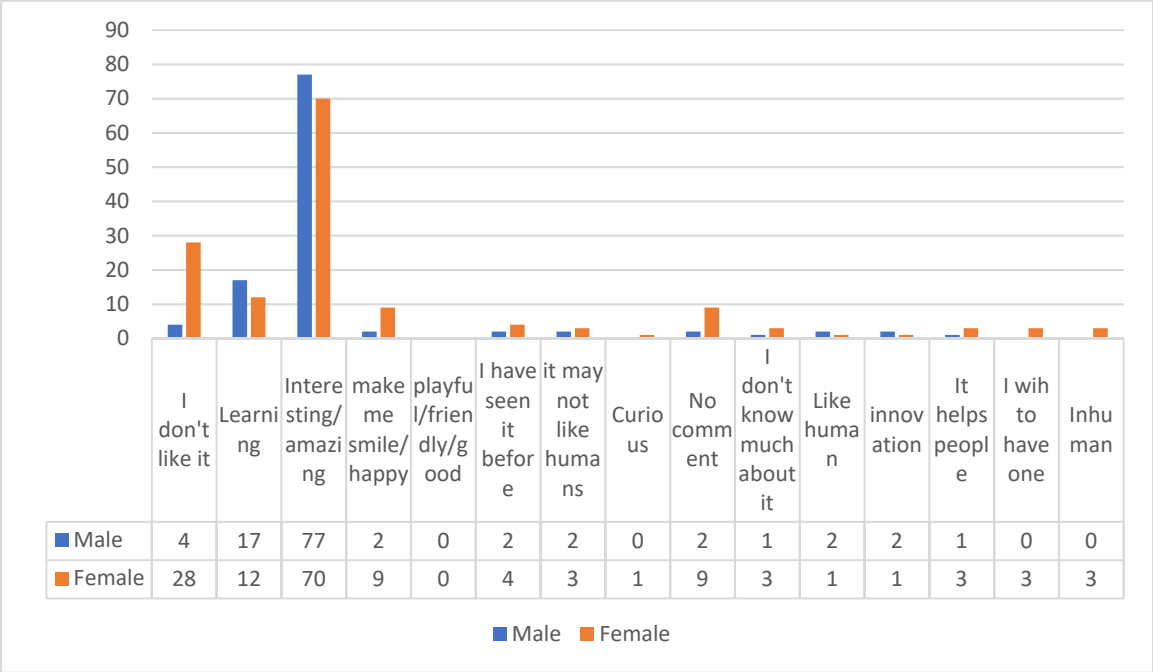


Figure 29. Chart Frequency & Descriptive test of Q13 Comment

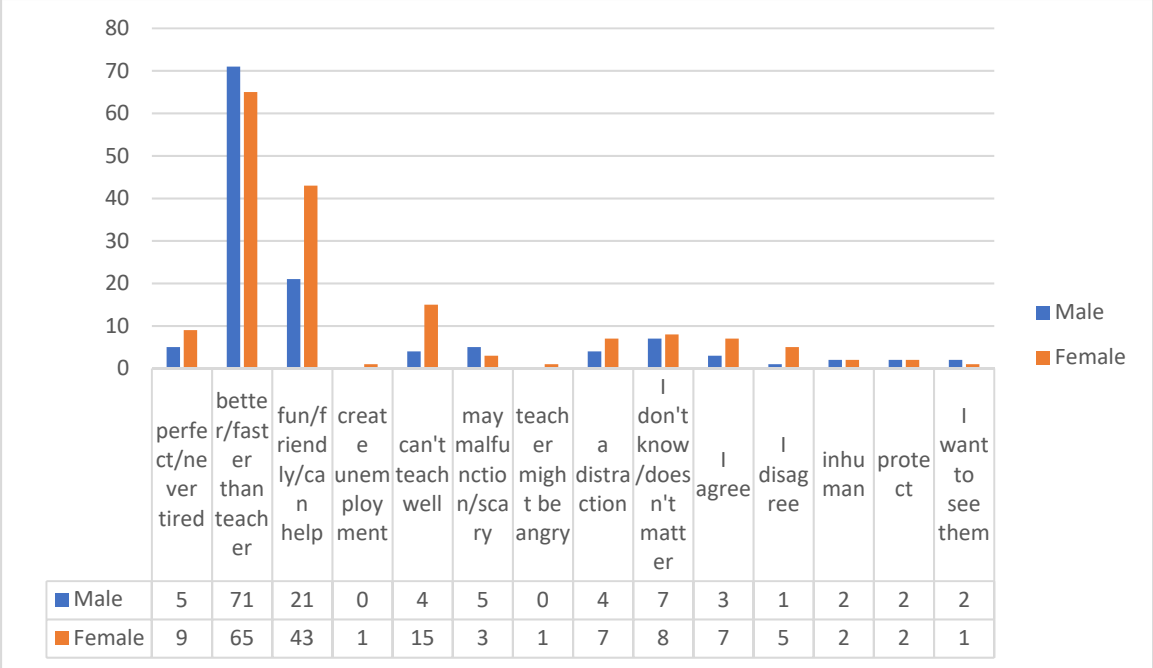
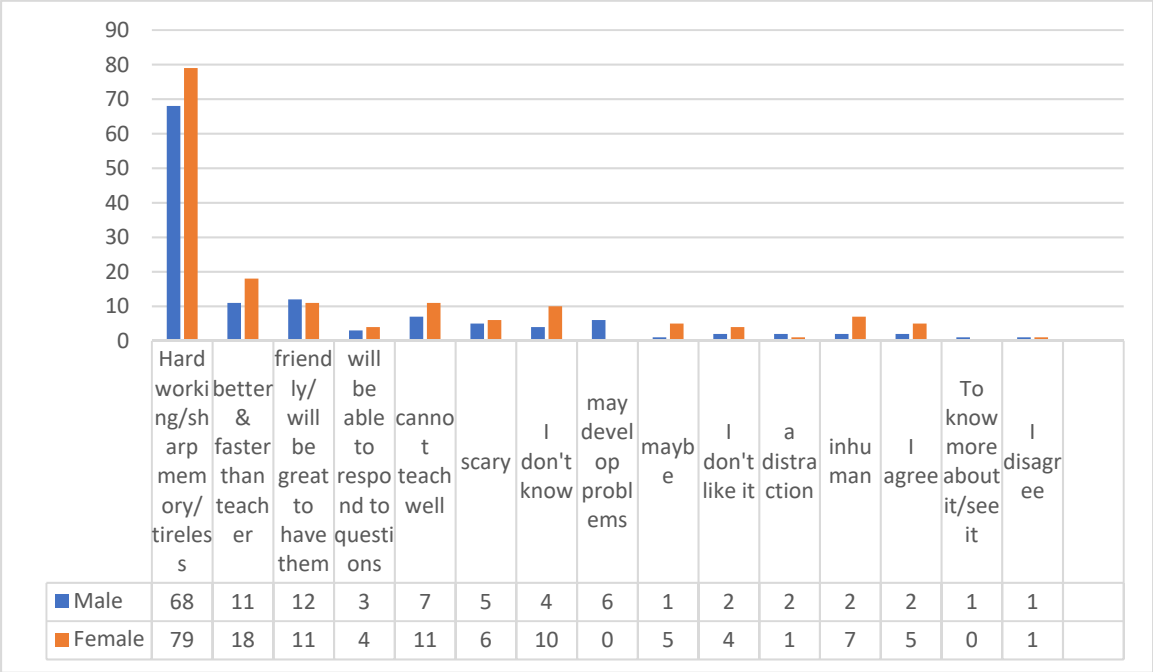
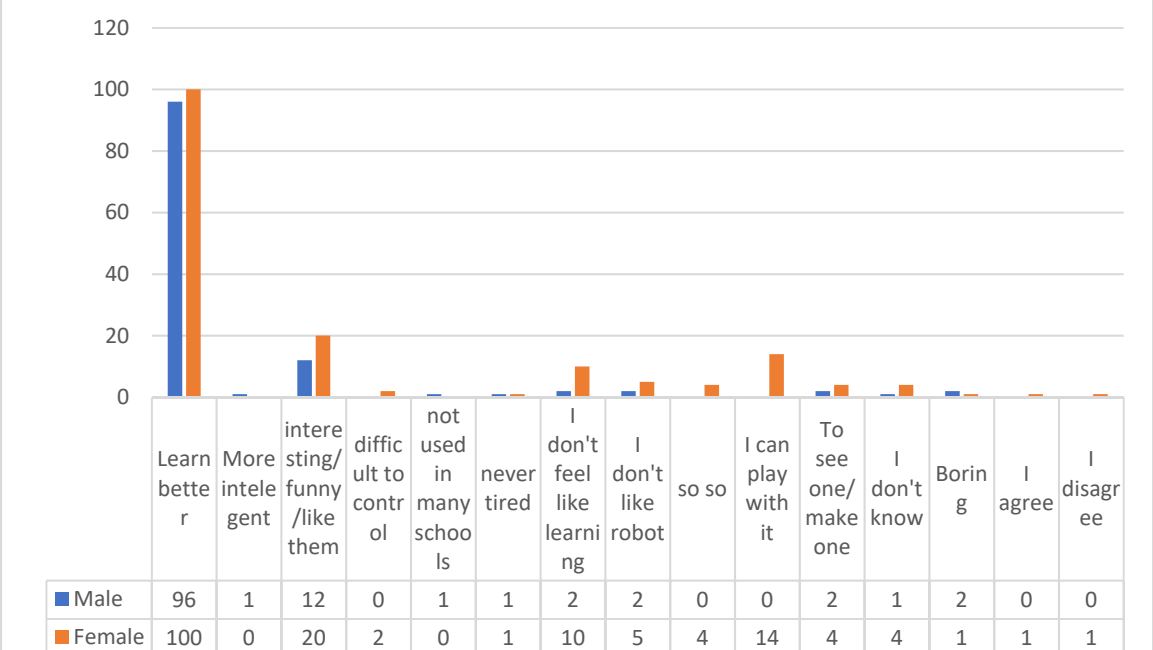


Figure 30. Chart Frequency & Descriptive test of Q14 Comment



	Hard working/sharp memory/ tireless	better & faster than teacher	friendly/ will be great to have them	will be able to respond to questions	cannot teach well	scary	I don't know	may develop problems	maybe	I don't like it	a distraction	inhuman	I agree	To know more about it/see it	I disagree
Male	68	11	12	3	7	5	4	6	1	2	2	2	2	1	1
Female	79	18	11	4	11	6	10	0	5	4	1	7	5	0	1

Figure 31. Chart Frequency & Descriptive test of Q15 Comment



	Learn better	More intelegent	interesting/ funny /like them	difficult to control	not used in many schools	never tired	I don't feel like learning	I don't like robot	so so	I can play with it	To see one/ make one	I don't know	Boring	I agree	I disagree
Male	96	1	12	0	1	1	2	2	0	0	2	1	2	0	0
Female	100	0	20	2	0	1	10	5	4	14	4	4	1	1	1

Figure 32. Chart Frequency & Descriptive test of Q16 Comment

Table 31 shows the t-test results of the male and female students for the role items.

Table 31. t-test Analysis Role Preference Humanoids – Combined

		Descriptive Statistics			t test		
		N	Mean	SD	t	df	p
Role	Male	95	1.9763	0.66352	-1.143	218	0.254
	Female	125	2.0740	0.59908			

5.3.1.2.3 ***Size.*** The male and female students' size preference for humanoid robots was also tested to answer the research question: Do male students and female students like different types of humanoid robots? Independent t-test analysis was performed on two items to prove the hypothesis below:

H3: Female students are different from male students in their humanoid robot size preference

Large (adult) and Mini (child-like) size humanoids were considered in this study. Table 32 lists the t-test results for these two groups.

Table 32. t-test Analysis for Size of Humanoids

		Descriptive Statistics			t test		
		N	Mean	SD	t	df	p
Size	Male	95	2.8842	0.35320	-1.303	218	0.194
	Female	125	2.9560	0.59908			

There are no significant differences in male and female students' humanoid robots' size preference. Female students (M = 2.9560, SD = 0.59908) and male students (M = 2.8842, SD = 0.35320) (t = -1.303, p = 0.194). Since p is > 0.05, we accept the NULL hypothesis and conclude that there is no statistically significant association between the students' gender and their humanoid robots' size preference. *H3 is rejected*. It will be discussed later. These results can also be seen in Figure 33 & 34. Both male and female students prefer smaller humanoid robots to larger ones.

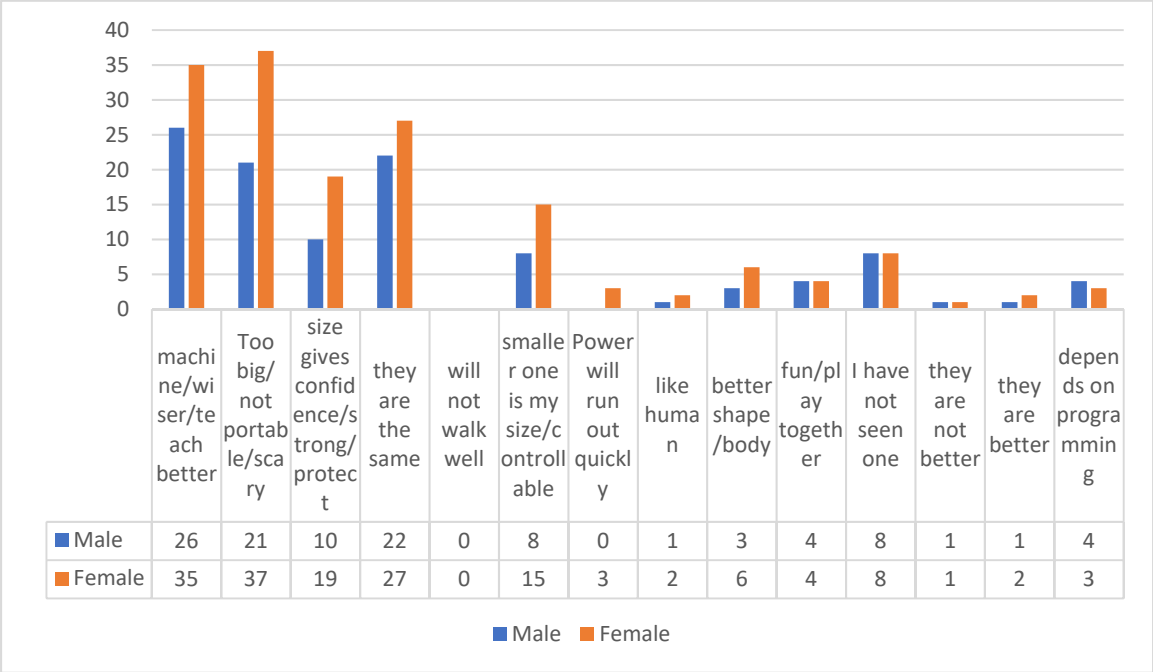


Figure 33. Chart Frequency & Descriptive test of Q20 Comment

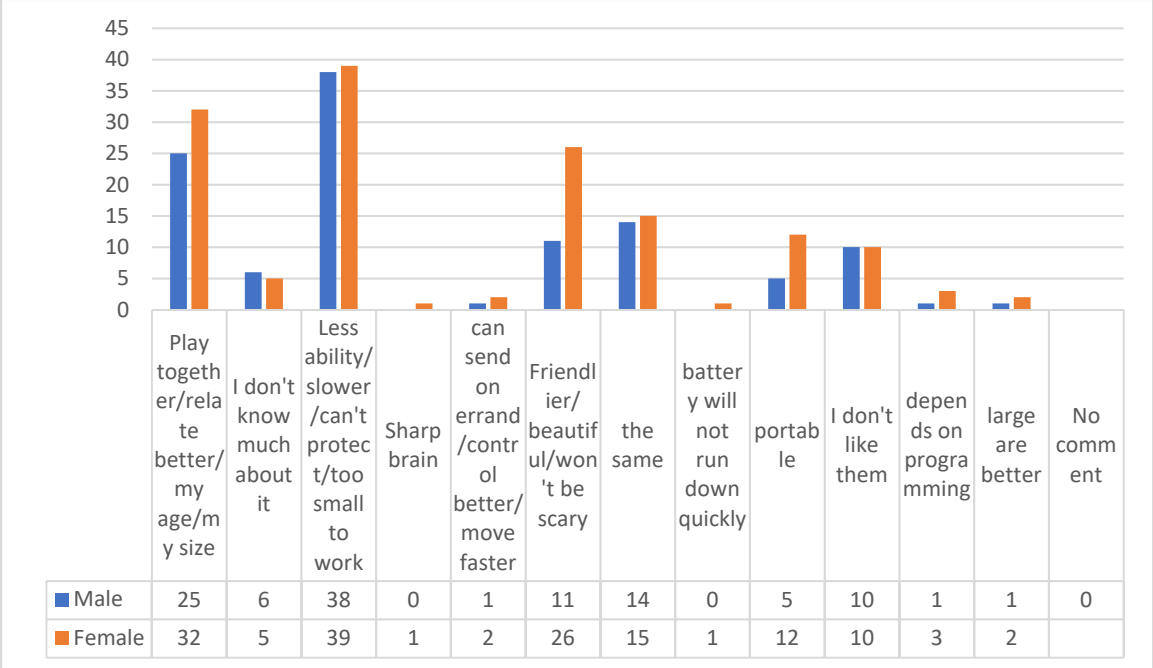


Figure 34. Chart Frequency & Descriptive test of Q21 Comment

5.4 Findings

Several important findings were discovered from the data analyzed. These findings will give a clearer view of students' preference and attitude towards humanoid robots and

this will allow the futuristic development of a more adoptable humanoid robot. The findings are categorized into three: common findings (those that have been proven in other research), important findings (those that were proven by this research) and unexpected findings (those that were not supported by this research).

5.4.1 Common Findings.

Best Toy

H5 is confirmed for the item Q3 analysis.

From the result of the analysis of the Nigerian Q3 item: "the toy I like best", we see that both male and female students have different first choices of best toy. Female students like dolls best followed by teddy bear while male students like cars best followed by super hero action figures. The same result was also gotten from the Taiwan analysis, both male and female students differ in their choice of best toy. Overall the choice of toy seems to be determined by the students' gender. As expected the result follows the norm since among children, females like dolls and males like cars.

Robot is one of the least favorable toys of the students, very few students see robots as toys, 13.1% male students and 4.6% female students see humanoid robot as toys.

5.4.2 Important findings.

Gender

H5, H5A, H5B, H5C& H5E are confirmed in the analyses of the Gender items.

The analysis results (of combined data) show that there are significant associations between the humanoid robots' gender and the students' gender. The students' gender seems to determine which gender the students would want humanoid robots to be. Though both male and female students want humanoid robots to be either male or female as their first choice, their second option is quite different. Male students want humanoid robots to be male while female students want them to be female. This is probably because

each one of them prefers members of their own sex. It is also true for their opinion about which humanoid robot they prefer and which one they would like to interact with. The male students will prefer and like to interact with male humanoid robots while the female students will prefer and lie to interact with female humanoid robots. They also have the same opinion that female humanoid robots are more cheerful and friendlier.

Pictures & Videos

H5A is confirmed for the combined datasets.

From the analysis of the Nigerian humanoid pictures and videos, we see that male students like male humanoids best while female students like female humanoids best. The same is true for the analysis of the Taiwan data. Each gender seems to prefer humanoid robots of their own gender. This also confirms the result gotten from the analysis of the gender item Q6. This shows that the students' humanoid robot gender preference is influenced by their own gender. This result can also be explained by the fact that dolls (baby dolls and Barbie) are female students' favorite toy, while cars and action figures are male students' best toy. We can conclude that the gender of the students impacts their humanoid robot gender preference.

5.4.3 Unexpected Findings.

Age I learnt about Humanoid Robot

H5 is not confirmed for the Q1 item.

From the analysis of the data from Nigeria and Taiwan, we find that both male and female students learned about humanoid robots at about the same age of Ten and Twelve. Nigerian students learnt about humanoid robots at the age of twelve followed by age ten while Taiwan students learnt about humanoid robots at the age of ten followed by the age of twelve. Since both male and female students start school at the same age they will most likely learn about new things at the same time. This result show that the age students learn about humanoid robot is not dependent on the students' gender.

Source of information about humanoid robots

H5 is not confirmed for the Q2 item.

In the analysis of Q2 items of both Nigeria and Taiwan data, the students' (both male and female) most common source of information about humanoid robots is cartoons/films followed by an instructor which is mostly from school. This confirms the result gotten earlier from the analysis of the "age students learnt about humanoid robots". Male and female students start school at the same time (age), and they learn about the same things at the same time. This result show that students' source of information about humanoid robot is not affected by the students' gender but rather by their time and method of exposure.

Role & Opinion

H4A, H4A1, H4B H4B1, H4C & H4D are not confirmed for the role items.

There are great similarities in the result of the analysis of the Q4 items of both Nigeria and Taiwan. In both cases, the results show that both male and female students would like to have humanoid robots assisting with domestic chores. Though they would also like to have humanoid robots in the teaching capacity, it is not one of their first two choices. As seen with the result of Q4 items, the analysis of the Nigeria and Taiwan Q5 items are also similar. The results show that both male and female students have similar opinion about humanoid robots. They both think that humanoid robots are smart, strong, cool and that they are like humans. This similarity in opinion about humanoid robots and their roles suggests that the students' gender does impact their idea on what humanoid robots' role or functions should be.

In the analysis of the combined role items, both male and female students have similar reasons for their opinion of humanoid robots and what its role should be. They both believe that humanoid robots are more fun and amazing, that they are better and faster than teachers and that they will learn more from humanoid robots.

Attitude

H1, H2A & H2B are rejected for the attitude items.

In the analysis of the combined attitude items (of combined data), both male and female students have similar attitude towards humanoid robots. The reason can be seen in Figures 26, 27 & 28. Both male and female students enjoy interacting with humanoid robots and they both like humanoid robots. The reason for their attitude is explained by the fact that they both believe that humanoid robots are friendly, beautiful and hardworking.

Gender

H5D is not confirmed for the gender items.

In the tests for "which humanoid robot would you prefer to learn from" (of combined data), there is no significant difference in male and female students' humanoid robot gender preference. They both wish to learn from female humanoid robots. Their gender does not influence their choice of which humanoid robot they want to learn from.

Size

H3 is rejected for the size items.

There are some similarities in the choice of the humanoid robots' size the male and female students prefer. More students believe that smaller humanoid robots are better because they are controllable and same size as them. The size preference is not impacted by the students' gender.

The results of all the hypotheses test can be seen in Table 33.

Table 33. Hypotheses and analyses results

	No.	Hypothesis	Result	Page
H1	H1	Female students have more positive attitude towards humanoid robots than male students.	REJECTED	71
H2	H2A	Female students interact more positively with humanoid robots than male students	REJECTED	71
	H2B	Female students like humanoid robots more than male students	REJECTED	71
H3	H3	Female students are different from male students in their humanoid robot size preference	REJECTED	48, 59, 78
H4	H4A	Female students' opinion of humanoid robots is different from that of male students	REJECTED	54, 64, 74
	H4A1	Female students think that humanoid robots will make good tutors while male students don't	REJECTED	64, 74
	H4B	Female students' perception about humanoid robots' role is different from that of male students	REJECTED	52, 62, 74
	H4B1	Female students wish to have humanoid robots as helpers in class while male students don't	REJECTED	52, 62, 74
	H4C	Female students show more positive interest in humanoid robots than male students	REJECTED	74
	H4D	Female students wish to learn more about humanoid robots while male students don't	REJECTED	74
H5	H5	Humanoid robots' gender affects how male and female students will accept them	CONFIRMED	45, 56
	H5A	Humanoid robot's gender has more effect on how female student will accept humanoid robots than on how male students will accept them	CONFIRMED	46, 47, 57, 58, 68
	H5B	Female students differ from male students in their opinion that female humanoid robots are friendlier than male humanoid robots	CONFIRMED	68
	H5C	Female students differ from male students in their opinion that female humanoid robots are more cheerful than male humanoid robots	CONFIRMED	68
	H5D	Female students differ from male students in their preference to learn from female Humanoid robot more than male humanoid robots	REJECTED	69
	H5E	Female students differ from male students in their preference to interact more with female Humanoid robot than male humanoid robots	CONFIRMED	69

6 Discussion and Conclusion

6.1 Discussion

Gender, Pictures & Videos

H5, H5A, H5B, H5C & H5E are confirmed in the analyses of the Gender items, H5A is also confirmed for Picture & Video items

The students' gender seems to determine which gender the students would want humanoid robots to be. The male students prefer male humanoid robots because they are tall, strong and can protect also because they are handsome and looks like them. The female students prefer female humanoid robots because they are beautiful and are female. The students that took part in this survey are between the ages of 11 and 16 and a higher number of them are in the age 12 bracket. Children within this age bracket usually play with members of their own sex. They are not yet that interested in members of the opposite sex. This might be responsible for the result.

In the analyses of the picture and video items, male and female students each prefer members of their own sex. This also confirms the result gotten from the analysis of the gender item. This result can also be explained by the fact that dolls (baby dolls and Barbie) are female students' favorite toy, while cars and action figures are male students' best toy. We can conclude that the gender of the students impacts their humanoid robot gender preference.

Role & Opinion

H4A, H4A1, H4B H4B1, H4C& H4D are not confirmed for the role items.

Both male and female students have the same role expectations and opinion of humanoid robots. Both male and female students would like to have humanoid robots assisting with domestic chores. They both also think that humanoid robots are smart, strong, and that they are like humans. The students probably have this opinion because corporal punishment still takes place in these countries and teachers are feared and

reverenced. They seem to like the idea of having humanoid robots in class as they believe, that and the class will be interesting and fun and that the humanoid robots will be friendlier and more approachable than teachers.

Attitude

H1, H2A & H2B are rejected for the attitude items.

In the analysis of the combined attitude items, both male and female students have similar attitude towards humanoid robots. The reason can be seen in Figures 26, 27 & 28. Both male and female students enjoy interacting with humanoid robots and they both like humanoid robots. The reason for their attitude is explained by the fact that they both believe that humanoid robots are friendly, beautiful and hardworking. It can also be explained by the fact that they both have the same source of information about humanoid robots.

Size

H3 is rejected for the size items.

More male and female students believe that smaller humanoid robots are better because they are controllable and same size as them. They will be able to play, control, and send smaller humanoid robot on errand. The preference is mainly due to how they want to associate with the humanoid robot and not by their gender.

6.2 Summary

Humanoid Robots are thought to be able to interact independently with humans in a socially meaningful way. Therefore, humanoid robots should be designed in a way that their form, behavior and personality conform to that of humans (Joosse et al., 2013). This will allow students to interact more effectively with humanoid robots thereby developing the ability to use their imagination and to make valued choices in life. More research is required to make sure these skills are developed in all children (Alimisis, 2013).

This research has been able to determine that:

- Students' gender has effects on their acceptance of humanoid robots.
- Students' gender affects their gender choice of humanoid robots.
- Students' gender affects their likeness for humanoid robots.
- Students' gender affects their opinion of what humanoid robots' role is.

The research has also determined that:

- Students' attitude towards humanoid robots is not controlled by the students' gender.
- Students' interaction with humanoid robots is not controlled by the students' gender.
- Students' humanoid robots' size preference is not controlled by the students' gender.
- Students' opinion of humanoid robots is not controlled by the students' gender

6.3 Conclusion

The findings of this research will give us a better understanding of how male and female students perceive and respond to robots. This knowledge will guide robotic companies in the futuristic design of humanoid robots that will be easily accepted and adopted by both male and female students as well as by teachers into the educational system.

When students like and accepts humanoid robots that are integrated into the school system, teaching and learning becomes more effective and productive and as research as proven, the students will learn and retain knowledge better.

Another benefit of a well-integrated humanoid robot in the education system is that teachers now have the much-needed assistance. They will be less stressed, more focused and freer to give more attention to each student. This will make learning more effective and productive.

Another benefit of this research is that the revised questionnaire that was used in this study will become available to other student for their research.

6.4 Future Work

From the result of the analysis, we find that male students prefer male humanoid robots while female students prefer female humanoid robots. More research is required to determine which humanoid robot should be placed in each class (to avoid gender bias) so that all students will benefit from their integration.

There is a need for continuous study to find ways to design and develop humanoid robots that will be more humane and acceptable to both male and female students as well as their teachers, so that students can interact more effectively with them.

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Appendix A – Pilot Questionnaire

Hello,

Thank you for participating in our survey. Your feedback is important to us. The purpose of this survey is to understand the gender issues that may affect the use of humanoid robots in education so that better educational humanoid robots can be developed in the future. There are four sections in this survey, they are: general information, short answer open-ended questions, five-point Likert scale followed by short-answer explanation, and selections of humanoids from pictures and video clips.

Please answer these questions based on your real thought. The data collected from this questionnaire will be used for research only. Any information you provide will be confidential. There are no known risks to you completing this survey.

Regards,

Mojibola Abioye

Athabasca University, Canada.

Section A: General Information
Please answer the following questions (Pg. 1/5)

A1. My code is___
Put in the code you generated earlier with instructions given to you.

A2. I am a
Boy
Girl

A3. I am _____ years old

A4. My race is_____
Asian
African/African-American
Caucasian
Hispanic
Other

A5. I am in Grade/Form_____

A6. The name of my school is____

A7. My present country of location is _____

A8. I was born in the month of ____

A9. Give a name of a character (in a movie, cartoon, animation, book or game) that you like most

A10. Randomly pick any number from 1 to 100

Section B: Short Answer Questions
Please answer the following questions (Pg. 2/5)

B1. I knew what a humanoid robot is when I was about ___ years old

B2. The most common way that I got information about humanoid robot is
Cartoons/films in television
Classmates
Internet
Books
Parents
Other

B3. In all my toys, I like ___ most

B4. When someone talked about humanoid robot, the following ideas came to mind
Idea 1
Idea 2
Idea 3

B5. If I had a humanoid robot, I would want it to
a
b
c

B6. I believe humanoid robot should be
Male
Female
Male or Female
No gender

B7. Which humanoid robot do you think will be more cheerful?
Male
Female
Male or Female
No gender

B8. Which humanoid robot do you think will be friendlier?
Male
Female
Male or Female
No gender

B9. If you were to choose, which humanoid robot will you prefer to interact with?
Male
Female
Male or Female
No gender

B10. Which humanoid robot will you prefer?
Male
Female
Male or Female
No gender

B11. If you were to have a humanoid robot as a teaching assistant in class, which one would you prefer to learn from?
Male
Female
Male or Female
No gender

Section C: Short Answer with Explanation
Please give reasons for your answer in the comments field (Pg. 3/5)

C12. Humanoid robots are amazing creatures
Strongly Disagree
Disagree
Neutral
Agree
Strongly Agree

C13. I am interested in the humanoid robot stuffs (e.g. movies or books)
Strongly Disagree
Disagree

Neutral
Agree
Strongly Agree

C14. Humanoid robots will make good teaching assistants in the class
Strongly Disagree
Disagree
Neutral
Agree
Strongly Agree

C15. A Teaching Assistant supports children with their learning activities in the classroom. They work closely with teachers to make sure pupils enjoy learning in a safe and caring place. I wish to have a humanoid robot as a teaching assistant in the class
Strongly Disagree
Disagree
Neutral
Agree
Strongly Agree

C16. A tutor teaches students and helps them in learning. Humanoid robots will be good tutors.
Strongly Disagree
Disagree
Neutral
Agree
Strongly Agree

C17. I wish schools will have a class teaching about humanoid robot.
Strongly Disagree
Disagree
Neutral
Agree
Strongly Agree

C18. I will enjoy interacting as a friend with the humanoid robot.
Strongly Disagree
Disagree
Neutral
Agree
Strongly Agree

C19. I have some doubts about humanoid robots.
Strongly Disagree

Disagree
Neutral
Agree
Strongly Agree

C20. I believe larger adult size humanoid robot is better than the small child size one.
Strongly Disagree
Disagree
Neutral
Agree
Strongly Agree

C21. I prefer mini child size humanoid robots.
Strongly Disagree
Disagree
Neutral
Agree
Strongly Agree

C22. I don't like humanoid robots.
Strongly Disagree
Disagree
Neutral
Agree
Strongly Agree

C23. I like humanoid robots.
Strongly Disagree
Disagree
Neutral
Agree
Strongly Agree

Section D: Humanoid Robot selection from pictures
Using the pictures above, please answer the following questions. (Pg. 4/5)

D1.
From the pictures, I like___ best (choose only One)
Because
I also like__ (you may choose many)

D2.
Please check this box if you don't like any of them
I do like some of them and have filled out the text boxes above

Section E: Humanoid Robot Selection from Video Clips

Using the video clips below, please answer the following questions (Pg. 5/5)
Humanoid Robot 1
Humanoid Robot 2
Humanoid Robot 4
Humanoid Robot 5

E1.
From the following video clips, I like___ best (Please use 1, 2, 4, 5 and choose only one)
Because
I also like__ (Please use 1, 2, 4, 5 and you may choose many)

E2.
Please check this box if you don't like any of them
I do like some of them and have filled out the text boxes above

The End!!!
Thank You.

Appendix B – Study Code Generator

Students' study codes will be generated by asking each of them to answer the three questions listed below with the instructions on how to generate their study codes. This will be the key for differentiating participants' responses.

Step 1 - answer the following three questions and write down the answers (Please note that you are also required to enter the answers to the online questionnaire):

a. Which month were born (please spell out the month's full name)?
[Example, April]

b. Give a name of character (in a movie, cartoon, animation, book, or game) that you like most. Spelling incorrectly is totally OKAY! [Example, Laura]

c. Randomly pick a number from 1 to 100. [Example 99]

Step 2 - fill up the blank below

Your secret string: the name of character you gave + the number you picked from 1 to 100: according to the example answers given above, the secret string will be Laura99

Step 3 - answer the following question

Your secret position: A year has twelve months. What is the number of the month you were born? For example, April is the 4th month in the year, so 4 is the answer: 4

Step 4 - generate code

Your Study Code: insert the month's full name into your secret string at the secret position. For example, my secret string isLaura99 and my secret position is 4 and April is the month, I shall insert April to the 4th position of Laura99 and make my Study Code --> LauAprilra99

Please note that if your secret position is not available in your secret string, when you get to the end of your string go back to the beginning and resume counting again. For example, my secret string is Laura99 and my secret position is 12 and December is the month, I shall insert December to the 12th position of Laura99 to make my Study Code, but Laura99 does not have a 12th position, so I will start counting from beginning (L) to end (9) which is the 7th position, then I will go back to the beginning and resume counting again from 8 till I get to the 12th position my Study Code will then be --> LaurDecembera99 (you can repeat as many times as you have to till you get your position).

Appendix C – Consent Form & Information Letter

CONSENT FORM
Consent form for parents and child to agree to participate in the study.

Consent (Parents):
I have read this letter of information and have had all my questions answered to my satisfaction. I will keep a copy of the information letter and the consent form for my records. My signature below is meant to confirm that:

- I understand the expectations and requirements of my child's participation in the research;
- I understand the provisions around confidentiality and anonymity;
- I understand that my child's participation is voluntary, and that my child is free to withdraw at any time with no negative consequences;
- I am aware that I may contact the Research Ethics Board of Athabasca University if I have questions, concerns, or complaints about the research procedure.

Print Parent's Name: _____ Date: _____
Print Names of Children: _____ Parent's Signature: _____

Consent (Child):
I have read this letter of information and/or have had my parent(s) explain the study to me. I have had all my questions answered to my satisfaction either by my parent(s) or by the researcher(s) or both. My signature below is meant to confirm that:

I understand the expectations and requirements of my participation in the research;
I understand the provisions around confidentiality and anonymity;
I understand that my participation is voluntary, and that I am free to withdraw at any time with no negative consequences;
I am aware that I may contact the Research Ethics Board of Athabasca University if I have questions, concerns, or complaints about the research procedure.

Print Names of Children: _____ Date: _____
Signatures of Children: _____

Information Letter Parents

Hello Parents,

I am a researcher from the Athabasca University, Alberta, Canada. I am exploring the different gender issues that can affect the use of humanoid robots in education. We invite your child, with your full consent, to take part in a study that tests the effects of various gender issues on the use of humanoid robots in education. The test is very simple, your child will be given some video clips and pictures of different types of humanoid robots to watch and look at, after which they will now take a survey about their opinion of the humanoid robots they had just seen.

Before starting the survey, your child will be required to take a simple short pre-test on some basic concepts of humanoid robots to determine their level of knowledge of humanoid robots after which they will be shown the pictures and the clips of the humanoid robots and then complete the survey. There are no risks of any kind to your child as a participant in this study. Participation is voluntary, and your child can withdraw from the study at any time. If withdrawn, the child's data will be destroyed. As well your child will not be penalized in any way if they decide to withdraw from the study. The data we collect will be used for evaluation purposes for this study only. The data will not be used for any other purpose except to appear as a summary of analysis when we publish the result.

If you have any further questions about this research or participation, you are welcome to contact my supervisor Dr. Maiga Chang (maigac@athabascau.ca) and at any time. This study has been reviewed by the Athabasca University Research Ethics Board. Should you have any comments or concerns regarding your treatment as a participant in this study, please contact the Office of Research at +1-780-675-6718 or by e-mail to rebsec@athabascau.ca.

Please review this letter with your child so they are aware of the study and what is required to participate in this study, please have the consent form signed by yourself and your child.

Sincerely,
Mojibola Abioye

The Principal,
Acada High School,
Modakeke, Osun State,
Nigeria.
28/12/2015

PERMISSION TO CONDUCT A SURVEY IN YOUR SCHOOL

My name is Mojibola Abioye. I am a researcher from the Athabasca University, Alberta, Canada. I am conducting a study titled: Gender Issues Affecting the Use of Humanoid Robots in Education.

The goal of using humanoid robots in education is to make learning more effective and successful. One way of achieving this goal is to have a good understanding of students' perception and opinion of humanoid robots. This understanding will assist researchers and developers in designing humanoid robots that are more users friendly and adaptable as well as to allow the development of different strategies for introducing students to robotics technologies by teachers and educators.

I will need your grades 7, 8 and 9 students to take part in a study that tests the effects of various gender issues on the use of humanoid robots in education. The test is very simple; your students will be completing an online survey which involves their watching some video clips and looking at pictures of different types of humanoid robots and then answering some questions about the clips and pictures. 270 students from grades 7, 8, and 9 will be required in all, 90 students from each of the grades respectively. If you have any questions about this research, please don't hesitate to contact me at jibola_abiye@yahoo.com or +1-403-532-1372. You can also contact my supervisor Prof. Maiga Chang (maigac@athabascau.ca) at any time.

I will need your approval and support to conduct the study in your school.

Thank You for your kind consideration,

Yours Sincerely,
Mojibola Abioye

The Principal,
Christ Ambassador Comprehensive College,
Osogbo, Osun State,
Nigeria.
10/12/2017

PERMISSION TO CONDUCT A SURVEY IN YOUR SCHOOL

My name is Mojibola Abioye. I am a researcher from the Athabasca University, Alberta, Canada. I am conducting a study titled: Gender Issues Affecting the Use of Humanoid Robots in Education. The goal of using humanoid robots in education is to make learning more effective and successful. One way of achieving this goal is to have a good understanding of students' perception and opinion of humanoid robots. This understanding will assist researchers and developers in designing humanoid robots that are more users friendly and adaptable as well as to allow the development of different strategies for introducing students to robotics technologies by teachers and educators.

I will need your grades 7, 8 and 9 students to take part in a study that tests the effects of various gender issues on the use of humanoid robots in education. The test is very simple; your students will be completing an online survey which involves their watching some video clips and looking at pictures of different types of humanoid robots and then answering some questions about the clips and pictures. 270 students from grades 7, 8, and 9 will be required in all, 90 students from each of the grades respectively. If you have any questions about this research, please don't hesitate to contact me at jibola_abiye@yahoo.com or +1-403-532-1372. You can also contact my supervisor Prof. Maiga Chang (maigac@athabascau.ca) at any time.

I will need your approval and support to conduct the study in your school.

Thank You for your kind consideration,

Yours Sincerely,
Mojibola Abioye

The Principal,
Our Lady & St. Francis Catholic College,
Osogbo, Osun State,
Nigeria.
12/12/2017

PERMISSION TO CONDUCT A SURVEY IN YOUR SCHOOL

My name is Mojibola Abioye. I am a researcher from the Athabasca University, Alberta, Canada. I am conducting a study titled: Gender Issues Affecting the Use of Humanoid Robots in Education. The goal of using humanoid robots in education is to make learning more effective and successful. One way of achieving this goal is to have a good understanding of students' perception and opinion of humanoid robots. This understanding will assist researchers and developers in designing humanoid robots that are more users friendly and adaptable as well as to allow the development of different strategies for introducing students to robotics technologies by teachers and educators.

I will need your grades 7, 8 and 9 students to take part in a study that tests the effects of various gender issues on the use of humanoid robots in education. The test is very simple; your students will be completing an online survey which involves their watching some video clips and looking at pictures of different types of humanoid robots and then answering some questions about the clips and pictures. 270 students from grades 7, 8, and 9 will be required in all, 90 students from each of the grades respectively. If you have any questions about this research, please don't hesitate to contact me at jibola_abiye@yahoo.com or +1-403-532-1372. You can also contact my supervisor Prof. Maiga Chang (maigac@athabascau.ca) at any time.

I will need your approval and support to conduct the study in your school.

Thank You for your kind consideration,

Yours Sincerely,
Mojibola Abioye

Appendix D – Final Questionnaire

Hello,

Thank you for participating in our survey. Your feedback is important to us. The purpose of this survey is to understand the gender issues that may affect the use of humanoid robots in education so that better educational humanoid robots can be developed in the future. There are four sections in this survey, they are: general information, short answer open-ended questions, five-point Likert scale followed by short-answer explanation, and selections of humanoids from pictures and video clips.

Please answer these questions based on your real thought. The data collected from this questionnaire will be used for research only. Any information you provide will be confidential. There are no known risks to you completing this survey.

Regards,

Mojibola Abioye
Athabasca University, Canada.

Section A: General Information
Please answer the following questions (Pg. 1/5)

A1. My code is___
Put in the code you generated earlier with instructions given to you.

A2. I am a
Boy
Girl

A3. I am _____ years old

A4. My race is_____
Asian
African/African-American
Caucasian
Hispanic
Other

A5. I am in Grade/Form_____

A6. The name of my school is____

A7. My present country of location is _____

A8. I was born in the month of ____

A9. Give a name of a character (in either a movie, cartoon, animation, book or game) that you like most

A10. Randomly pick any number from 1 to 100

Section B: Short Answer Questions
Please answer the following questions (Pg. 2/5)

B1. I knew what a humanoid robot is when I was about ___ years old

B2. The most common way that I got information about humanoid robot is
Cartoons/films in television
Classmates
Internet
Books
Parents
Instructor
Other

B3. In all my toys, I like ___ most

B4. When someone talked about humanoid robot, the following ideas came to mind
Idea 1
Idea 2
Idea 3

B5. If I had a humanoid robot, I would want it to
a
b
c

B6. I believe humanoid robot should be
Male
Female
Male or Female
No gender

B7. Which humanoid robot do you think will be more cheerful?
Male
Female
Male or Female
No gender

B8. Which humanoid robot do you think will be friendlier?
Male
Female
Male or Female
No gender

B9. If you were to choose, which humanoid robot will you prefer to interact with?
Male
Female
Male or Female
No gender

B10. Which humanoid robot will you prefer?
Male
Female
Male or Female
No gender

B11. If you were to have a humanoid robot as a teaching assistant in class, which one would you prefer to learn from?
Male
Female
Male or Female
No gender

Section C: Short Answer with Explanation
Please give reasons for your answer in the comments field (Pg. 3/5)

C12. Humanoid robots are amazing
Strongly Disagree
Disagree
Neutral
Agree
Strongly Agree

C13. I am interested in the humanoid robot stuffs (e.g. movies or books)
Strongly Disagree
Disagree
Neutral
Agree

Strongly Agree

C14. A Teaching Assistant supports children with their learning activities in the classroom. They work closely with teachers to make sure pupils enjoy learning in a safe and caring place. I wish to have a humanoid robot as a teaching assistant in the class
Strongly Disagree
Disagree
Neutral
Agree
Strongly Agree

C15. A tutor teaches students and helps them in learning. Humanoid robots will be good tutors
Strongly Disagree
Disagree
Neutral
Agree
Strongly Agree

C16. I wish schools will have a class teaching about humanoid robot
Strongly Disagree
Disagree
Neutral
Agree
Strongly Agree

C17. I will enjoy interacting as a friend with the humanoid robot
Strongly Disagree
Disagree
Neutral
Agree
Strongly Agree

C18. I don't like humanoid robots
Strongly Disagree
Disagree
Neutral
Agree
Strongly Agree

C19. I like humanoid robots
Strongly Disagree
Disagree
Neutral
Agree

Strongly Agree

C20. I believe larger adult size humanoid robot is better than the small child one.
Strongly Disagree
Disagree
Neutral
Agree
Strongly Agree

C21. I prefer mini child size humanoid robots.
Strongly Disagree
Disagree
Neutral
Agree
Strongly Agree

Section D: Humanoid Robot selection from pictures
Using the pictures above, please answer the following questions. (Pg. 4/5)

D1.
From the pictures, I like___ best (choose only One)
Because
I also like__ (you may choose many)

D2.
Please check this box if you don't like any of them
I do like some of them and have filled out the text boxes above

Section E: Humanoid Robot Selection from Video Clips
Using the video clips below, please answer the following questions (Pg. 5/5)

Humanoid Robot 1
Humanoid Robot 2
Humanoid Robot 4
Humanoid Robot 5

E1.
From the following video clips, I like___ best (Please use 1, 2, 4, 5 and choose only one)
Because
I also like__ (Please use 1, 2, 4, 5 and you may choose many)

E2.
Please check this box if you don't like any of them
I do like some of them and have filled out the text boxes above

The End!!!
Thank You.

Appendix E – Certification of Ethical Approval

Athabasca University
RESEARCH CENTRE

The future of learning.

CERTIFICATION OF ETHICAL APPROVAL

The Athabasca University Research Ethics Board (AUREB) has reviewed and approved the research project noted below. The AUREB is constituted and operates in accordance with the current version of the Tri-Council Policy Statement: Ethical Conduct for Research Involving Humans (TCPS) and Athabasca University Policy and Procedures.

Ethics File No.: 22157
Principal Investigator: Mrs. Mojibola Abioye, Graduate Student, Faculty of Science & Technology\Master of Science in Information Systems
Supervisor: Dr. Maiga Chang (Supervisor)
Project Title: Gender Issues Affecting the Use of Humanoid Robots in Education
Effective Date: April 11, 2016 Expiry Date: April 10, 2017

Restrictions:
Any modification or amendment to the approved research must be submitted to the AUREB for approval.

Ethical approval is valid for a period of one year. An annual request for renewal must be submitted and approved by the above expiry date if a project is ongoing beyond one year.

A Project Completion (Final) Report must be submitted when the research is complete (i.e. all participant contact and data collection is concluded, no follow-up with participants is anticipated and findings have been made available/provided to participants (if applicable)) or the research is terminated.

Approved by: Date: April 11, 2016
Ali Akber-Dewan,
Chair School of Computing & Information Systems,
Departmental Ethics Review Committee

Athabasca University Research Ethics Board
University Research Services, Research Centre
1 University Drive, Athabasca AB Canada T9S 3A3
E-mail: rebsec@athabascau.ca
Telephone: 780.675.6718

Appendix F – Certification of Ethical Approval Renewal

Athabasca University
RESEARCH ETHICS BOARD

The Future of Learning.

CERTIFICATION OF ETHICAL APPROVAL – RENEWAL

The Athabasca University Research Ethics Board (AUREB) has reviewed and approved the research project noted below. The AUREB is constituted and operates in accordance with the current version of the Tri-Council Policy Statement: Ethical Conduct for Research Involving Humans (TCPS) and Athabasca University Policy and Procedures.

Ethics File No.: 22157
Principal Investigator: Mojibola Abioye, Graduate Student, Faculty of Science & Technology
Project Title: 'Gender Issues Affecting the Use of Humanoid Robots in Education'
Supervisor: Maiga Chang, Associate Professor, Faculty of Science & Technology
Effective Date: July 4, 2017 Expiry Date: July 3, 2018

Restrictions:
Any modification or amendment to the approved research must be submitted to the AUREB for approval.

Ethical approval is valid for a period of one year. An annual request for renewal must be submitted and approved by the above expiry date if a project is ongoing beyond one year.

A Project Completion (Final) Report must be submitted when the research is complete (i.e. all participant contacts and data collection is concluded, no follow-up with participants is anticipated and findings have been made available/provided to participants (if applicable)) or the research is terminated.

Approved by: Date: July 4, 2017
Joy Fraser, Chair
Athabasca University Research Ethics Board

Athabasca University Research Ethics Board
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