DOI : 10.3745/JIPS.2008.4.3.97

Comparison of Cultural Acceptability for Educational Robots between Europe and Korea

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Abstract: Europeans are much more rigid in their thinking on robots and especially have a negative view on robots as peers since they regard robots as labor machines. Recently, Korea invented several educational robots as peer tutors. Therefore, study was needed to determine the difference in cultural acceptability for educational robots between Korea and Europe (Spain). We found that Europe seems to be much more rigid in its thinking on robots and especially has a negative view on educational robots. Korean parents have a strong tendency to see robots as 'the friend of children,' while on the other hand, European parents tend to see educational robots as 'machines or electronics'. Meanwhile, the expectation of children on educational robots showing identification content was higher in Europe than in Korea since European children are familiar with costume parties. This result implied that we may find a Korean market for educational robots earlier than a European market, but European children will be eager to play with educational robots even though their parents have a negative view of them.

Keywords: *Cultural Acceptability, Educational Robot, Identification, Robot Contents*

1. Introduction

Humans cannot be satisfied with their various desires in real life. Thus humans created a substitute to replace their role and be identified as equally human itself. Examples are expressing God as a human image in myths, creating the resembled image of one's self in movies, and inventing robots with human-like appearance.

The advancement of IT technology and development of the Internet enabled psychological identification to expand to the cyber world. For example, there are commercial effects when an avatar represents him or herself in the cyber world or when a hero's face in the fairy tale is replaced with a portrait shot [1,5,6]. Applications of identification in education have brought the development of self-esteem and learning ability [5,6].

However, it needs a lot of technical effort to build content based on identification with computers. Since identification content can be made by inserting your own digital image from a camera into original content, it was very difficult to provide public service. If educational robots can automatically make identification content, this drawback can be overcome.

Since the appearance of robots reduces fear of machines and enables emotional interaction with humans [10], learning motivation and its synergy effect of educational use are endless [3,5,6]. However, it is unknown whether identification robot content may play the role of a global killer application. So we will investigate whether identification contents of educational robots are effective or not, and how different the acceptability is for educational robots between Europe and Korea. That is why the concept of robots in Europe and America is rather passive and they are seen as laborers while the concept of robots in Korea or Japan is perceived positively as a friend of humans [9]. We assume that it is not easy to use identification content of educational robots in Europe or America where the concept of robots is based on them being laborers. It is necessary to investigate cultural acceptability for robots in the education field.

The results of the comparison of cultural acceptability of robots between Korea and Europe can contribute to the design and development of content for educational robots and global marketing.

※ This work was supported by the Korea Research Foundation Grant funded by the Korean Government (KRF-2006-H0004).
Manuscript received April 10, 2008; revised September 18, 2008; accepted September 22, 2008.

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2. Related Work

2.1 Identification

The definition of identification mechanism refers to how

one perceives others as oneself [1]. For example, one may equate oneself with a character in literature or a theater play. That is to identify oneself with another with distinction.

Although the terminology of identification mechanism refers to similar meanings, it may vary depending on the situation. Potter defines the concept of identification in the respect of television media as when someone gets deeply involved in the main characters' attraction and intends to develop a relationship with the main characters in television [11]. Raviv (1996) commented that the identification phenomenon is expressed by showing strong respect for the characters in the media and sometimes collecting information about a star or private stuff of a star and meeting a star privately. Moreover, it includes imitating stars' hair styles, fashion styles, language and behavior patterns.

The educational robot can download educational content from the server whenever and wherever, and can automatically reconstruct it into identification content using a camera, and then show it through an LCD monitor as you see in Figure 1[5,6].

Fig. 1. Example of Identification Content

2.2 National Perception on Robots

Bae (2007) points out that there is a difference in the perception of robot among countries. To western people, robots are perceived as labor machines for humans because the word ‘robot’ derives from the drama, ‘Rossum's Universal Robots' written by Karel Capek, a Czech writer, in 1920. ‘Robota’ means labor in Czech and the word ‘robot’ was invented excluding the 'a' in robota.

However, Korea, China and Japan have the moderate view of a robots as a 'machine human or friend', unlike western culture. Thanks to animation like 'Atom' and 'Doraimong' in Japan there are strong views on robots as being humans’ friend. Since there is social atmosphere which respects elderly people and protects youth in China, robots are written in Chinese as '機器人:Cyborg'. The above unique cultural difference has brought a gap in the view of robots.

Not only among countries but also among primary, junior high school and high school students, there are gaps in the robot image. Kim and Shin (2007) did a survey on the general image of robots to students. The results follow. Primary school students had an image of a 'wizard' that could perform tasks impossible for humans. Junior high school and high school students had an image of a 'helper’ that makes human life much more comfortable.

Nomura et al. (2008) internationally compared the perception of robots of undergraduate students in Japan, Korea and America. The results showed that Japanese students perceive human-size humanoid robots as much more liberal and emotional beings than Korean and American students. Also Japanese students did not have an either excessively positive or negative image of robots.

The different point of view on robots gives an influence on development of robots. In Europe, industrial or nursing robots are advanced. In Japan, the capacity is focused on the development of humanoid robots or pet robots such as ASIMO. The many educational robots such as teaching assistants or peer tutors are developed in Korea. Therefore, to place educationals robot as global killer applications, the deep cultural acceptability of a country is necessary.

2.3 Cultural Acceptability

The factor to measure cultural acceptability is derived from ‘system acceptability’ in HCI. Nielsen (1993) suggested that in order to accept a new system into our daily life, both the social acceptability and practical acceptability needs to be met. The factors of practical acceptability are usefulness, cost, compatibility, reliability, etc.

Shackel (1991) proposed that system acceptability consists of utility, usability, and likeability which are suitable depending on costs. Utility means necessary function, usability means that user may perform the task successfully using the system, and likeability means that user may sense the system is suitable.

Table 1. The Factors of Cultural Acceptability

Nielsen(1993)		Shackel(1991)			Cultural Acceptability
Social Acceptability		Likeabi-lity	Utility	Cost	Market Acceptability of Robots Acceptability of Educational Utility
Practical Acceptability	Usefulness	Usability	Utility		Expectation of Robot’s Role Expectation of Utility for Contents based on Identification
	Compatibi-lity				
	Reliability				
	Cost				

Nielsen and Shackel's system of acceptability are both reflective of the engineering and psychological fields. However, we adopted the factors of the psychological view in Table 1. For social acceptability or likeability factor, we consider market acceptability of robots and educational utility. For practical acceptability, we propose the expectation of a robot's role and it's utility for content based on the identification mechanism. Through these factors, we are able to know the expectation from the response of students with identification mechanism content in robots.

3. Comparison of Cultural Acceptability

3.1 Sample Design

The survey was conducted by questioning a total of 65 children and 95 of their parents. Among parents, 54 were European and 41 were Korean. Out of the 65 children in the survey, there were 24 European children and 41 Korean. The background information of respondents follows in Table 2.

Table 2. Respondents Distribution

Parent			#	Parent			#
Sex	Europe	M	22	Age	Europe	below 30	31
		F	32			30-40	15
	Korea	M	7			Above40	8
		F	34		Korea	Below30	1
Total			95			30-40	28
						Above40	12
				Total			95
Children			# of case	Children			# of case
Sex	Europe	M	14	Grade	Europe	1-2	18
		F	10			3-4	2
	Korea	M	18			5-6	4
		F	23		Korea	1-2	1
Total			65			3-4	31
						5-6	9
				Total			65

The survey responses for educational utility acceptability, expectation of content utility based on identification, where each response consisted of one of 5 scale-points (① Not at all, ② below Average, ③ Average, ④ Above Average. ⑤ Very likely). Average and standard deviation was calculated, then T-test and F-test, as well as a Tukey before-after comparison, were conducted. The survey questions of expectation rate of a robot's role and identification content consisted of nominal scales, so a Chi-square test was conducted.

3.2 Educational Utility Acceptability

Table 3 shows the acceptability of educational utility of robots for children and parents in Europe and Korea. European parents have a relatively negative view on utilizing robots for educational use (average 2.66). Korean parents have a relatively positive view (average 3.59). This difference shows statistical significance ($p<0.05$). Especially, the parents of European female children, substantial demanders of educational robots, have a relatively negative view (average 2.45) compared to the parents of Korean female children. This is statistically significant ($p<0.05$).

Table 3. Acceptability of Educational Utility

Country			AVG (M)	STDIV (SD)	T or F	p-value
Parents	Europe		2.66	0.87	T=25.098	.000
Parents	Korea		3.59	0.93	T=25.098	.000
Parents	Europe	M	2.95	0.90	F=9.96	.000
Parents	Europe	F	2.45	0.80	F=9.96	.000
Parents	Korea	M	3.57	0.93	F=9.96	.000
Parents	Korea	F	3.59	0.94	F=9.96	.000
Children	Europe		2.29	0.66	T=35.94	.000
Children	Korea		3.59	0.93	T=35.94	.000
Children	Europe	M	2.32	0.46	F=11.65	.000
Children	Europe	F	2.25	0.89	F=11.65	.000
Children	Korea	M	3.56	0.87	F=11.65	.000
Children	Korea	F	3.61	0.99	F=11.65	.000

The Tukey test for before & after comparison of parents by country is shown in Table 4. This result reflects the European parents' thought that education should be conducted by humans. It is expected that Korea would utilize robots much more actively than Europe. The average of European childrens' acceptability of the educational utility of robots is 2.29. The average of Korean children, 3.59, is very similar to the acceptability of parents. The difference among groups is statistically significant ($p<0.05$). Especially, the average of European female children is 2.25 which is the most negative view on educational utility of robots. In contrast, the average of Korean female children is 3.6, which is the most positive view on the educational utility of robots.

Table 4. Tukey Comparison

Parents	Europe(F)		Korea(M)		Korea(F)	
Parents	Diff. Avg	p-value	Diff. Avg	p-value	Diff. Avg	p-value
Europe(M)	.501	.178	-.617	.379	-.634	.050
Europe(F)			-1.118	0.16	-1.135	.000
Korea(M)					-0.17	1.000
Children	Europe(F)		Korea(M)		Korea(F)	
Children	DA	LS	DA	LS	DA	LS
Europe(M)	0.71	.997	-1.234	.001	-1.287	.000
Europe(F)			-1.306	.001	-1.359	.000
Korea(M)					-0.53	.999

4. Comparison of Cultural Acceptability for Educational Robot's Contents

4.1 Identification

The identification mechanism of educational robots is to show and read picture books to a child after inserting a real face (photo) as a main character in a fairy tale (see Figure 1). The survey was conducted with a question for parents, "How necessary are educational robots with an identification mechanism at a price of €200~€1500 (₩260,000~₩2,000,000) in the upcoming three years?" The results are shown in Table 5.

Table 5. Acceptability of Identification

Identification	Case (N)	Avg (M)	ST.DEV. (SD)	T	p-value
European	54	2.44	0.84	12.959	.001***
Korean	41	**3.07**	0.85	12.959	.001***
Total	95	2.72	0.90		

The total average of Korean parents shows 3.07 (St.dev. 0.84) which is relatively higher than 2.44 (Standard Deviation 0.84) for European parents. The difference of the averages ($p<.05$) is statistically significant. Therefore, it is expected that identification mechanism robot will be more active in Korea than in Europe.

4.2 Educational Robots' Roles

The comparison of response by countries was conducted to analyze the expectation of the role of robot a with the question, "Which roles do you expect for home robots and educational robots with an identification mechanism?" Table 6 is the response of the function of home robots by country.

Table 6. Expected Role for Parents

Freq. (%)		Secretary (Servant)	Friend	Electronics (Machine)	Computer	$\chi 2$ (p-value)
Home Robot	Europe	7 (13)	**3 (5.6)**	**31 (57.4)**	13 (24.1)	12.834 (.005**)
	Korea	10 (24.4)	**7 (17.1)**	9 (22.0)	**15 (36.6)**	
Edu. Robot	Europe	1 (1.9)	**11 (20.4)**	**22 (40.7)**	20 (37.0)	17.580 (.001**)
	Korea	2 (4.9)	**23 (56.1)**	4 (9.8)	12 (29.3)	

57.4% of Europeans responded that a home robot is 'Electronics or Machine', and 5.6% responded 'Friend of Children'. 36.6% of Koreans responded 'a Sort of Computer' and 17.1% of Korean parents responded 'a Friend of Children'. The difference of thought on the robots' role is statistically significant ($p<0.05$). Therefore, Europeans think of home robots as electronics which have the following functions: home security, traffic information, schedule alarm service, and reading the bible. On the other hand, 40.7% of Europeans responded that educational robots are 'Electronics or Machine' and 20.4% responded 'Friend of Children'. 29.3% of Koreans responded that educational robots are 'a Sort of Computer'. The difference in thought of the identification mechanism robots' role is statistically significant ($p<0.05$). Therefore, Koreans think of identification mechanism robots as friends of children.

The interesting thing is the different view on home robots and educational robots with identification mechanism. 5.6% of Europeans responded that home robots are the friend of children, while 20.4% of Europeans responded that educational robots with an identification mechanism are a friend of children. 17.1% of Koreans responded that home robots are the friend of children, while 56.1% of Europeans responded that identification mechanism robots are a friend of children. This indicates that the intimacy to robots may change depending on the function and content of robots. In the future, depending on the role and orientation of development of robots, robots may be more close and friendly to our life and also robots may be utilized educationally.

4.3 Expectation on Identification

The survey was conducted on the expectation of positive roles (heroes) of characters, the expectation of utilization of identification contents, and the expectation of negative roles (villains) such as Figure 2.

Fig. 2. An Example of a Hero and Villain

Table 7 shows the expected response of children in class when they play the role of a main character in the content. The average of students is 3.72 (SD 0.99), which is substantially high. Also, the expected average of European children 4.21 (SD 0.72), which is much higher than Korean, 3.43 (SD 1.02). Statistically, it is significant ($p<0.05$). Thus, it is expected that European children would pay more attention and enjoy the class using content with the main character in the fairy tale.

Table 7 also shows about expected response of students when students in the class play the role of a bad character in the content. The average of students is 2.57 (SD 0.82)

Table 7. Expectation for Roles in Fairy Tales

Positive (Hero)	Case (N)	AVG (M)	SIDEV. (SD)	T	p-value
Europe	24	4.21	.72	10.442	.002**
Korea	41	3.43	1.02	10.442	.002**
Negative(Bad Man)	Case (N)	AVG (M)	SIDEV. (SD)	T	p-value
Europe	24	2.40	.78	1.703	.197
Korea	41	2.66	.82	1.703	.197

which is substantially low. Also, the expected average of European students is 2.40 (SD 0.78) and Korean students' expected average is 2.66(SD 0.82). Statistically, the difference is insignificant ($p>0.05$). Thus, it is expected that both European and Korean students would not pay more attention to the class using content with a bad character in the fairy tale.

Table 8 is on the most wanted role of the identification mechanism content with the question, "Which one do you want to be, a hero or a supporting actor in the fairy tale?"

Fig. 3. Hero or Supporting Actor with Hero

62.5% of European children want to participate in the content as a main character. The Korean children were relatively positive to roles of both main character and friends of the main character. This is statistically significant ($p<0.05$). Therefore, it will work out better for European children academically than Korean when they play the role of a main character in the content.

Table 8. The Most Wanted Role

Nationality		Main character	Both are good	The friend of main character	$\chi 2$ (p-value)
Europe	#	**15**	7	2	6.828 (.033*)
Europe	(%)	**(62.5)**	(29.2)	(8.3)	6.828 (.033*)
Korea	#	13	**16**	12	6.828 (.033*)
Korea	(%)	(31.7)	**(39.0)**	(29.3)	6.828 (.033*)

5. Conclusion

In this paper, we surveyed to find out the cultural acceptability of identification mechanism educational robot in Korea and Europe. The three variables, 'level of perception for educational utility', 'the level of expectation of robot's role',and 'the level of expectation of utility of identification mechanism contents' was adopted based on Nielsen and Shackel's theory. Then, we collected the European and Korean data for daily life robots. We investigated that the identification mechanism for educational robots is much more necessary to Koreans than Europeans compared to its cost. Because of the thought that education should human, Europeans are negative toward educational robots. On the other hand, Koreans showed more positively on this issue than Europeans. Also, in Korea and Europe, people perceive home robots to be for roles such as 'home security, traffic information service, schedule alarm service, reading the bible' There is a strong perception of the identification mechanism as a 'friend of children' in Korea. However, there is tendency for Europeans to consider the educational robot with an identification mechanism as a friend of children. Finally, Europeans had a higher expectation of the utility of an identification mechanism robot than Koreans. They also had interest in being a main character rather than being a villain in the content. The implication of this result is that educational robots with an identification mechanism can change Europeans' view, deeply rooted in prejudice, that robots are machines or laborers. We guess that robot content based on an identification mechanism is more familiar to Europeans because they have more experience with costume parties than do Koreans. In the future, various kinds of content will be designed in order to change the negative view on using robots in education.

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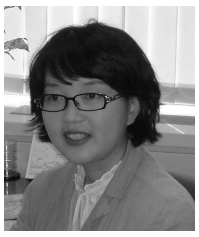

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