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Abstract

Culture education can use a myriad of media, and this research explores how a robot can be used for culture education. To conduct the research, a questionnaire-based survey was conducted on adult and non-adult users. The findings showed that the two groups of respondents when calculated together had a higher level of satisfaction with educational effectiveness and the significant value of the system (89%, 917/1030) than operational experience (84%, 862/1030) and the robot's sensory appeal (77%, 797/1030). The findings suggested that respondents had attached greater importance to the significant value and educational function of the robot-mediated system. Gaps existed between the two groups regarding their responses to the robot's sensory appeal (84% vs. 64%), interaction with the robot (85% vs.77%), and reflective assessments on the value of the system (91% vs. 85%). Despite the gaps, the robot-mediated culture educational system has proved to be effective as it is in line with Norman's (2004) visceral, behavioral and reflective needs of emotional design by creating a sensory appeal, giving users delightful operational experiences, and yielding positive assessments. The implications derived from the findings shed light on the educational value of using the robot as an agent of culture education.

Introduction

Culture education is crucial to the preservation of a country's or an ethnic group's culture traditions through the passing on from individual to individual or from groups to groups. Culture education can use a myriad of media, encompassing APP, web-based texts, Facebook, Twitter, blog, books, u-tubes, movies and relevant others. Scores of studies on culture education emphasize the relationship between culture education and human behavior (Smith & Kirby, 2008), formal models of culture education and evolution (Boyd & Richerson, 1985; Richerson & Boyd, 2005) or the observations of real-world culture phenomena (Rogers, 1995).

However, no research has been conducted to investigate the impact of robot used as the agent of culture education on users. Since the human-like robot has a lovely external appearance and can dance with cute gestures, it can attract people to use it to achieve various purposes. Driven by this perception, the author of this paper made an investigation to explore how far the design of a robot-mediated culture education system can meet public users' expectations, what factors have caused their positive or negative reactions and how different groups of users show different responses to the robot-mediated culture educational system.

Many studies have addressed the effectiveness of robot applications to language education, healthcare, medical therapy, business, robotic culture, and ethical concern. Han et al. (2015) discussed how humanoid robots could be used to enhance children's learning motivation, and Blanson et al. (2013) explored how Nao (a robot) could be used to administer health education quizzes to increase student competence and autonomy. Sabelli & Kanda (2015) focused on the robot's guiding function in a shopping mall and respondents' positive reception. Some studies suggested the robot-aided medical functions such as stroke rehabilitation (Cherry et al., 2017; Basteris et al., 2014) or old people's healthcare function (Robinson et al., 2015) or assistance in the reduction of agitation, depression and dementia (Jøranson et al., 2015). Ethical concern issues were explored with a focus on the children's confused feeling about robots (Sparrow & Sparrow, 2006) and robot nannies' care to cause children's unhealthy and incomplete development in the social, linguistical, and emotional aspects (Sharkey & Sharkey, 2011). In the above robot-mediated applications, no room is left for culture education. Thus, this paper proposes the use of robot as the agent of culture education and investigates how users look at it.

An exhibition of the Pepper humanoid robot was hosted by a southern university in Taiwan at a shopping mall of Kaohsiung city in 2020. The author used this opportunity to conduct a questionnaire-based survey to understand the robot users' responses. The exhibition ran on two Sundays from 11AM to 5:30 PM. The robot's chest tablet displays culture information of divination verses, historical allusions, Taiwanese gods' stories and Taiwanese temple architectures. Audiences could interact with the robot choosing their favorite culture information and languages. Since many human-robot interaction studies (Fior et al., 2010; Shahid, et al., 2010, 2011) only assess children responses, the present investigation targets both groups—adults and non-adults. It is expected to identify how the two groups of users respond to the technological system of culture education in similar or different ways.

The present paper has four objectives:

(1) to understand what factors have caused adult and non-adult respondents' positive reactions to robot-mediated culture education system at the physical level,

(2) to investigate how adult and non-adult respondents engage with the robot-mediated culture education system emotionally,

(3) to probe how adult and non-adult respondents assess the robot-mediated culture education system reflectively, and

(4) to explore what implications this research suggests from the perspectives of culture education and product design.

To achieve the objectives, four research questions are raised, including

(1) what are adult and non-adult respondents' motivations for using the robot to acquire culture knowledge?

(2) what are adult and non-adult respondents' experiences of using the robot-mediated culture system?

(3) what are adult and non-adult respondents' assessment of the system? and

(4) what are significant implications derived from the findings of the present research?

The findings are expected to disclose whether adult and non-adult respondents have different or similar reactions to the robot-mediated culture educational system and how they are emotionally and cognitively engaged with the system. The research implications derived from the findings are also discussed.

Theoretical Review

To investigate whether a robot-mediated culture educational system is accepted by users, the present paper uses some important concepts of culture education and Norman's emotional design as the theoretical framework. The concepts are introduced at some length in this section.

Culture Education

Scientific insights of culture education hold that knowledge of various kinds needs to be explicitly introduced to individuals in diverse modes at specific time and space, not inherently tied to one's genes (Cavalli-Sforza & Feldman, 1981; Schönpflug, 2001). The explicit culture educational process can be enacted through various devices, including disciplinary teaching in family and systematic lectures at school, which help shape an individual's behavior and thinking. For culture anthropologists, children cognitively acquire adult competence through experiences, but actually culture acquisition must be reliant on the learning of explicit, complete and consistent knowledge (Boyer 1994). Culture knowledge is not acquired by genetic instinct, but is accumulated through education.

There are three types of culture education in general: vertical, horizontal and oblique types (Cavalli-Sforza & Feldman, 1981; Schönpflug, 2001). Family education belongs to vertical culture education that is achieved by parent teaching to children (Schönpflug, 2001). In contrast, horizontal education takes place when a culture trait is passed between members of the same generation and is frequently done by an infectious agent (Cavalli-Sforza & Feldman 1981). Oblique culture education often takes the form of formal or informal education that is accomplished through institutions or non-parental members of the parental generation to individuals (Cavalli-Sforza & Feldman, 1981). The above three types of culture education occur within families, peers, authoritative agents and institutions (Bergstrom & Dugatkinm, 2012; Ram, Liberman & Feldman, 2018). In the present paper, the robot-mediated culture education demonstrated to the public at a public venue belongs to oblique culture education.

The amount and content of information that is transmitted using the approach of oblique education is more flexible than other two types (Eerkens & Lipo, 2007). The robot-mediated culture education that belongs to the oblique type is not restricted in its way of information delivery, culture contents and target audiences. Thus, the robot-mediated culture education system can introduce the local religious culture, including divination verses and the stories of Taiwanese gods, using a multi-presentational system that combines visual, auditory and verbal components. The system can be presented to the public at open venues or to students at schools for culture education. This paper probed how the public looked at the system for culture learning when it was displayed at a mall.

Emotional Design of Products

Another theory used to support the robot-mediated culture education system is Norman's (2004) emotional design. Norman (2004) advised designers to build emotions into products, so users or customers could have positive emotion and pleasurable experiences. He called for designers' attention to users' perceptions and experiences without being restricted to the product's functionalities. The theory proposed three levels of design that could meet the customers' visceral, behavioral and reflective needs. The three levels are "based on the way our brain function and can be seen as guide to a more appealing, effective, pleasurable and memorable design" (Mehra, 2021, p.1). Visceral design is concerned with appearances; behavioral design, with the pleasure and effectiveness of use, and reflective design, with the rationalization and intellectualization of a product (Norman, 2004). A good visceral design can catch people's attention and make people eager to use it. Attractive things can work better (Norman, 2004).

The visceral level works instinctively, related to the users' immediate, automatic reaction to the sensory appearance of a product. The visceral level refers to the look and feel of a product, which determines whether the product can appeal and attract customers. The visceral quality of a design emphasizes the first impression made on customers. The behavioral design has much to do with the user's experiences. "What matters on this level is function performance and the physical feel of something" (Mehra, 2021, p. 3). Its focus is on the practical and functional aspects of a product. This means that the design of a product needs to address how the users feel about the operation of a product—usable, effective, and understandable or not (Norman, 2004). The reflective design takes aim at how the users reflect on their connection with the world through the product and how they judge the overall value and meaning of the product. This level defines the users' overall impressions of a product since they reflect on all aspects of the product, usually including "the messages sent, the meaning of the product and whether it is worth remembering" (Idler, 2012, p.5). The focus of reflective design is "the long-term impact of the design" on the users (Mehra, 2021, p. 4), and it enters into the assessment of the meaning of the product, the impact of thoughts and the share-ability of the experience (Baker, 2019).

Overall, the visceral design is about users' immediate feel, subconscious reactions and instinctive responses; the behavioral design, about "usability, effectiveness of use, pleaser of use, performance and function" (Szerovay, 2020, p.3), and the reflective design, about the users' satisfaction with the impact and meaning of the product. If the above three levels of design can be integrated in the right way, they would make a product effective and successful (Mehra, 2021). Thus, if the respondents in the present investigation are satisfied with the above three emotional levels, it suggests that the robot-mediated culture educational system is effective for culture education.

Methodology

In this paper, a questionnaire survey was conducted to investigate how adult and non-adult users responded to the technological system with the robot as the medium to introduce local culture to the public. The robot-mediated system design, transmitted culture texts and research methods are illustrated as follows.

The Robot and the Robot-Mediated Culture Educational System

The technological system is built on a child-sized, humanoid robot, named Pepper. This type of robot has two big eyes and its arms can move and make gestures. It was developed and launched by Softbank Robotics in 2014, supporting the text-to-speech function and offering four languages (i.e. Chinese, English, Japanese and German) for programmers to use. It is 120cm in height and is equipped with several tactile, laser, sonar, 3-D and infrared sensors, one IMU, two RGB camera, four microphones, a screen tablet, and six laser actuators. The robot's gaze makes people feel it is looking at their faces. It can detect the closest person and move towards him/her. These features make it appealing and intriguing to people.

The programming of Pepper in the present research aims to educate the public about Taiwan's local culture. The modeled behavior of Pepper emulates how a culture guide communicates with people and expects to engage users emotionally and cognitively. The operational procedures start with the robot's warm greetings to users and its introduction about its role of a culture guide. It then asks users their nationalities and the language they want to choose to read the culture texts.

Following the robot's instructions, the users need to choose one culture category from the given four including divination verses, stories of Gods, Taiwanese temple architectures and historical allusions. Each user can choose one text from each chosen culture category and read it along with the robot's voice. All actions are performed by touching the screen tablet on the robot's chest. Finally, users are asked whether to continue reading or want to move to a new category. Users may also choose dancing for entertainment. Finally, the robot says good-bye to the users and expresses its wish to see them again. Figure 1 shows the operational procedures users need to go through when interacting with the robot-mediated culture system.

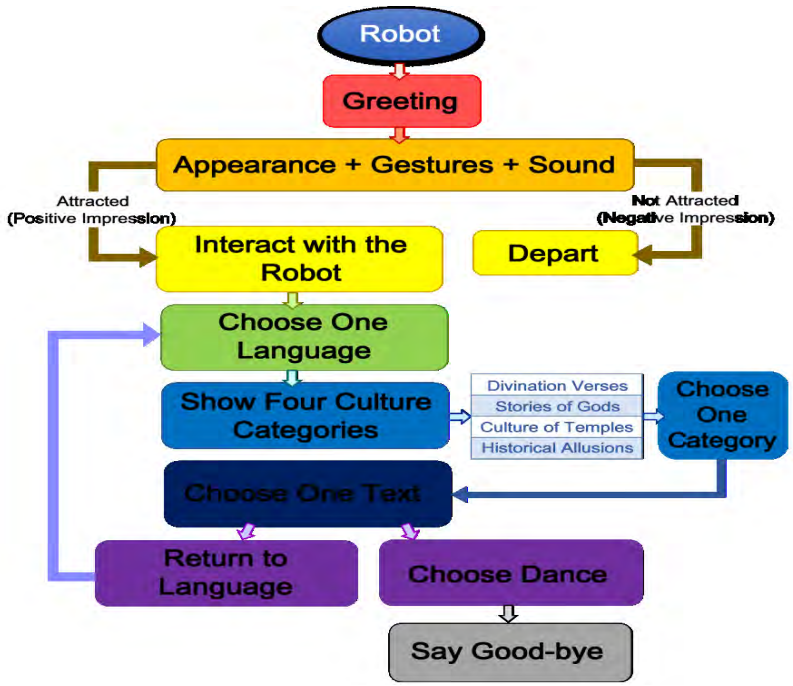

Figure 1. Procedures of Operating the Robot-mediated Culture Educational System

Completing the procedures of reading a text takes about five minutes, varying with the length of the chosen texts. On the two days of exhibition, no time limit was implemented on each individual user. However, should there be a long queue of people waiting to use the system, each user was allowed to have five-minute interaction with the robot. The users who wanted to use again needed to line up again.

Culture Texts for Public Education

The culture texts are collected from websites and then are adapted and translated by the author and her colleagues. The author feels that young people in Taiwan are increasingly obsessed with foreign culture and have overlooked their own culture. Asian people travelling abroad visit Western churches and learn stories about foreign gods, but they are distant from their own gods. Driven by the urgent need to rekindle Taiwanese's interest in their local culture, a team from the College of Foreign Languages at NKUST designed the program using the robot as the medium. Beautiful, animated pictures are used to help users comprehend the culture texts. Figure 2 shows how a user is choosing a text from the category of "Stories of Gods"; figure 3 shows how a chosen text entitled Fude God is shown on the robot's screen tablet. The picture of figure 3 is an animated one with the God's white beard swaying from side to side and the God's hand moving up and down. The picture is expected to help audiences to know the God's outlook and create visual effect. All animated pictures used in the system are developed by a private company and the copyright belongs to the Foreign Language College of a southern university in Taiwan.

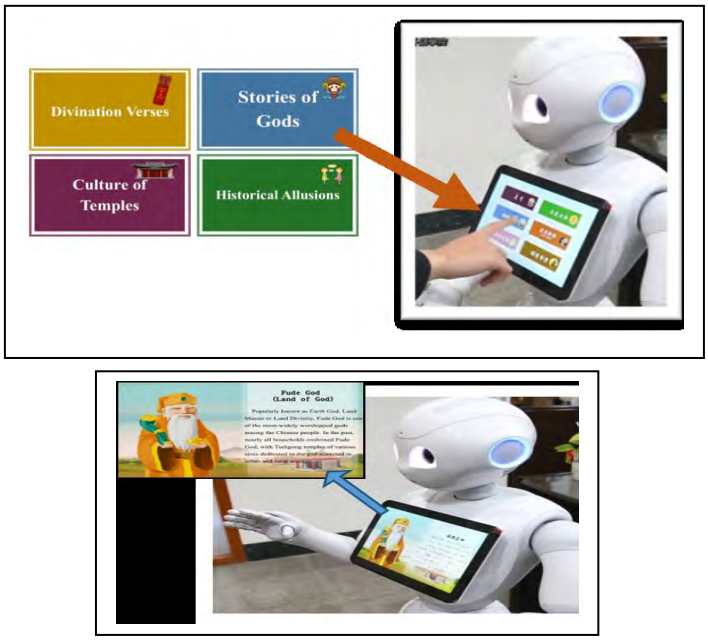

Figure 3. A Text on Fude God is shown on the Screen Tablet

A Questionnaire-based Survey

To understand how users look at the robot-mediated culture educational system, this research conducted a questionnaire-based survey. Information of participants and questionnaire design are introduced as follows.

Participants

The robot-mediated system was exhibited in a Kaohsiung shopping mall, attracting many people to watch and interact with the robot. Some audiences were invited to participate in a questionnaire-based survey, and were informed of the research objective. They could decide to join or reject the survey. To reduce their stress, they were not asked to sign a letter of consent. Finally, there are a total of 136 adults and 81 non-adults agreeing to participate in the questionnaire. But some questionnaires were done incompletely, so only 135 questionnaires from adults and 71 from non-adults were effective. Adult respondents were aged between 20 and 65, and non-adult respondents included children and teenagers, aged between 6 and 19. All of them had no experience of operating a robot in the past.

Some young children could not understand the questionnaire content, so their parents explained it to them. When children were accompanied only by their grandparents, they did the questionnaire with the assistance from university student assistants. Those who participated in the questionnaire obtained a gift as their reward.

Questionnaire Design

The major concerns of the survey are (1) how users are attracted by the robot-mediated culture educational system; (2) how users feel about the operational experience, and (3) how users evaluate the robot-mediated culture educational system. The first part emphasizes the users' motivation for using the technological system; the second part, the user's operational experiences, and the third part, the user's reflective assessment. There are a total of 15 items for investigation with 1-5 items that inquire about users' motivation in Part A; 6-10 items concerning the usability of the system in Part B, and 11-15 items regarding the value and benefits of the system in Part C.

Part A probes whether people use the robot due to its attractive outlook, dance movements, lovely voice, and cute gestures. It raises the concern about the use of the robot as the new technology to grab people's attention. Part B investigates whether users have a delightful interaction with the robot due to comprehensible culture contents, clear instructions and effective audio-visual aids. Part C upgrades the investigated items to the cognitive level, focusing on whether the technological system can boost users' interest in learning culture, enhance the educational effectiveness, offer valuable, interesting information worth the public's knowledge acquisition, and provide useful multi-lingual contents. Rating is based on a five-level scale, composed of "strong agree" (5 points), "agree" (4 points), "neither agree nor disagree" (3 points), "disagree" (2 points) and "strongly disagree" (1 point).

Results

This section answers four research questions raised in section 1, and some theoretical concepts are used to support the findings.

Motivation for Using the Robot-Mediated Culture Educational System

Table 1 presents adult respondents' motivation for using the robot. The adults placed high importance on the robot as a new technology (*M*=4.56, *SD*=0.64), followed by the robot's appearance (*M*=4.38, *SD*=0.73) and the robot's gestures (*M*=4.32, *SD*=0.76). They were less motivated by the robot's dance movements (*M*=4.27, *SD*=0.94) and its voice (*M*=4.05, *SD*=1.16). The statistical results showed that with strongly agree and agree being conflated, 92 % (124/135) of adults chose the new technology as the factor to attract users; 89% (120/135), the robot's gestures; 86% (116/135), the robot's appearance; 81% (110/135), the robot's dance movements, and 75% (101/135), the robot's voice.

Table 1. Adult Respondents' Motivation for Using the Robot-Mediated System

Items	*M*	*SD*	Percentage %				
			SA	A	N	D	SD
1. The robot is a new technology and grabs my attention.	4.56	0.64	63	29	8	0	0
2. The robot's gestures attract me	4.32	0.76	46	43	8	3	0
3. The robot's appearance attracts me.	4.38	0.73	52	34	14	0	0
4. The robot's dance movements are attractive to me	4.27	0.94	52	29	14	3	3
5. The robot's voice attracts me.	4.05	1.16	46	29	16	3	6

SA=strongly agree (5points); A=agree (4 points); N=neither agree nor disagree (3 points); D=disagree (2 points); SD=strongly disagree (1 point)

Table 2 shows that non-adult respondents placed the highest importance on the robot as a new technology (*M*=4.19, *SD*=0.98), and the robot's dance movements (*M*=4.04, *SD*=0.92), followed by the robot's appearance (*M*=3.92, *SD*=1.02). They were less attracted by the robot's gestures (*M*=3.65, *SD*=1.23) and its voice (*M*=3.27, *SD*=1.40). The statistical results show that with strongly agree and agree being conflated, 77% (55/71) of non-adults chose the tool of new technology as the factor to motivate their culture learning; 62 % (44/71), the robot's gestures; 66% (47/71), the robot's appearance; 69% (49/71), the robot's dance movements, and 45% (32/71), the robot's voice.

Table 2. Non-Adult Respondents' Motivation for Using the Robot-Mediated System

Items	*M*	*SD*	Percentage %				
			SA	A	N	D	SD
1. The robot is a new technology and grabs my attention.	4.19	0.98	50	27	15	8	0
2. The robot's gestures attract me	3.65	1.23	27	35	27	0	11
3. The robot's appearance attracts me.	3.92	1.02	35	31	31	0	3
4. The robot's dance movements are attractive to me	4.04	0.92	38	31	27	4	0
5. The robot's voice attracts me.	3.27	1.40	21	24	31	4	20

A comparison between the two groups shows that both adults and non-adults place their highest focus on the robot as a new technology, but non-adult respondents show a lower mean score and a higher SD score than adult respondents. This phenomenon means that non-adult respondents are less attracted by the robot as a new technology than adult respondents. For non-adult respondents, the second high mean score is dance movements (*M*=4.04, *SD*=0.92), but it is the robot's lovely appearance (*M*=4.38, *SD*=0.73) for adult respondents. Children and teenagers tend to feel thrilled by moving things than by stationary ones, so they focus on the robot's dance movements. In contrast, adults favor the robot's human-like shape with big, round eyes.

Both groups are least attracted by the robot's voice, with the higher mean and lower SD scores for adults (*M*=4.05, *SD*=1.16) than for non-adults (*M*=3.27, *SD*=1.40). This means that although the robot's voice is least acceptable, more adult respondents accept it than non-adults. The robot does not use the recording of natural human voice because natural human voice might be incompatible with the appearance of a robot (Walters et al., 2008). However, the findings showed that the robot's unnatural voice was not highly accepted by both groups, so it needs some technical modification in the future.

With strongly agree and agree being conflated, the overall findings about users' motivation showed that 84% (570/675) of adult respondents and 64% (227/355) of non-adult respondents were positive about the robot's sensory appeal. Despite a division between the two groups, when both groups are calculated together, 77% (797/1030) of respondents express their positive responses to the sensory appeal of the robot. This suggests that the robot design has met all users' visceral needs, and concurs with Norman's (2004) argument that people's biological wired-in experience mainly derives from their considerations of size, appearance, and sound. Since many users were emotionally impacted by the robot's physical features, they took delight in using the technological system for culture education.

Experiences of Using the Robot-Mediated System

In response to RQ2 regarding the users' operational experience, the adult respondents put their highest focus on comprehensible contents (*M*=4.44, *SD*=0.76), followed by clear instructions (*M*=4.43, *SD*=0.71) and delightful interaction with the robot (*M*=4.43, *SD*=0.76). They paid little attention to memorable experiences (*M*=4.38, *SD*=0.85) and audio-visual aids (*M*=4.35, *SD*=0.85). With strongly agree and agree being conflated, the statistical results showed that 87% (117/135) of adults were positive about delightful interaction with the robot;91% (123/135), clear instructions; 83% (112/135), effective audio-visual aids; 88% (119/135), comprehensible culture contents, and 88% (119/135), memorable experiences. Table 3 shows adult respondents' experiences of using the system.

Regarding the experience of interacting with the robot, non-adult respondents were mostly fond of interaction with the robot (*M*=4.23, *SD*=1.21), followed by clear instructions (*M*=4.19, *SD*=0.98) and audio-visual aids (*M*=4.19, *SD*=1.02). They put medium priority on the comprehensibility of the contents (*M*=4.08, *SD*=1.09) and lower priority on the memorable experience (*M*=3.81, *SD*=1.55). With strongly agree and agree being conflated, the statistical results showed that 77% (55/71) of non-adults were positive about interaction with the robot; 80%

(57/71), clear instructions; 77% (55/71), effective audio-visual aids; 79% (56/71), comprehensible culture contents, and 69% (49/71), memorable experiences.

Table 3. Adult Respondents' Experiences of Using the Robot-Mediated System

Items	*M*	*SD*	Percentage %				
			SA	A	N	D	SD
6. I am delighted to interact with the robot.	4.43	0.76	57	30	11	2	0
7.The system has clear instructions.	4.43	0.71	54	37	8	1	0
8. The system has effective audio-visual aids.	4.35	0.85	56	27	14	3	0
9.The culture contents are comprehensible	4.44	0.76	59	29	11	1	0
10.The experience of using the robot is memorable to me.	4.38	0.85	56	32	10	1	1

Table 4 shows non-adult respondents' experiences of using the robot-mediated system. For adults, the highest mean score is comprehensible culture contents, but it is delightful human-robot interaction for non-adults. This suggests that children and teenagers emphasize delightful interactions, but adults prefer the comprehensibility of culture texts. Non-adults enjoy human-robot interactions, but adults prioritize acquiring culture knowledge easily. A possible reason is that the culture contents are presented using some difficult words, so young children cannot understand them clearly. To make the texts tailored to different groups in the future, an easier version should be provided to non-adults, with the present version reserved only for adults. Users should be--or can be—allowed to choose the texts appropriate to their linguistic proficiency levels.

Table 4. Non-Adult Respondents' Experiences of Using the Robot-Mediated System

Items	*M*	*SD*	Percentage %				
			SA	A	N	D	SD
6. I am delighted to interact with the robot.	4.23	1.21	62	15	15	0	8
7.The system has clear instructions.	4.19	0.98	46	35	15	0	4
8. The system has effective audio-visual aids.	4.19	1.02	50	27	19	0	4
9.The culture contents are comprehensible	4.08	1.09	42	38	8	8	4
10.The operational experience is memorable to me.	3.81	1.55	50	19	11	0	20

Clear instructions get the second highest mean for both groups, showing that either adults or non-adults equally emphasize clear operational guidelines. Without providing clear instructions, users have no clue to operate the technological system. The finding concurs with Norman's (2004) call for a good behavioral design that helps people to use a product properly. Another finding worth our attention is that for non-adults, audio-visual aids (sound and pictures) get the second highest mean score (4.19), but they show the lowest mean score (3.81) for adults. Non-adults, particularly young children, might need to use the pictures as a scaffolding tool to increase their reading comprehension, but many adults can comprehend the culture contents without consulting pictorial materials. The different needs of the two groups lead to their different responses to audio-visual aids.

In total, 87.4 % (590/675) of adults and 76.6% (272/355) of non-adults (conflating strongly agree and agree) are positive about the experiences of interacting with the robot when answering the questionnaire questions 6-10. Despite the variation between the two groups, when both groups are calculated together, the findings show that 83.6% (862/1030) of respondents are positive about the operational experiences. Thus, the robot-mediated culture educational system can be assessed as designed properly, meeting Norman's (2004) claim that good product design is "human-centered, focusing upon understanding and satisfying the needs of the people who actually use the product" (p. 81).

Assessment on the Value of the Robot-Mediated System

With regard to adult respondents' assessment on the value, the findings showed that they attached the greatest importance to the educational effectiveness of the robot-mediated system (*M*=4.60, *SD*=0.61) and valuable culture information (*M*=4.57, *SD*=0.67), followed by interesting culture texts (*M*=4.56, *SD*=0.64) and boosting their culture learning interest (*M*=4.56, *SD*=0.76). They placed least importance on multi-lingual contents (*M*=4.41, *SD*=0.89). With strongly agree and agree being conflated, the statistical results showed that 91% (123/135) of adults agreed to the interesting culture texts; 94% (127/135), the educational effectiveness of the system; 93% (126/135), valuable culture information; 87% (117/135), multi-lingual contents, and 91% (123/135), boosting users' learning interest. Table 5 shows adult respondents' value assessment of the system.

Table 5. Adult Respondents' Reflective Assessment on the System

Items	*M*	*SD*	Percentage %				
			SA	A	N	D	SD
11. The culture texts are interesting to learn.	4.56	0.64	63	28	9	0	0
12. The robot-mediated system enhances the effectiveness of culture education.	4.60	0.61	67	27	6	0	0
13. The culture texts provide valuable information.	4.57	0.67	67	26	7	0	0
14. The system provides useful multi-lingual contents.	4.41	0.89	60	27	7	4	2
15. The system can boost my interest in learning local culture.	4.56	0.76	67	24	7	0	2

As to value assessment, non-adult respondents held the educational effectiveness of the technological system (*M*=4.69, *SD*=0.55) in high esteem, followed by their interest in the culture texts (*M*=4.58, *SD*=0.64) and valuable information (*M*=4.42, *SD*=1.03). Boosting their culture learning motivation was similarly their concern (*M*=4.38, *SD*=0.98). Their least interest was multi-lingual contents (*M*=4.31, *SD*=0.93). On the other hand, with strongly agree and agree being conflated, the findings showed that 92% (65/71) of adults agreed to the interesting culture texts; 96% (68/71), the educational effectiveness of the technological system; 80% (57/71),

valuable culture information; 76% (54/71), multi-lingual contents, and 80% (57/71), boosting their learning interest. Table 6 shows non-adult respondents' reflective assessment on the robot-mediated system

Table 6. Non-Adult Respondents' Reflective Assessment on the System

Items	*M*	*SD*	Percentage %				
			SA	A	N	D	SD
11. The culture texts are interesting to learn.	4.58	0.64	65	27	8	0	0
12. The robot-mediated system enhances the effectiveness of culture education.	4.69	0.55	73	23	4	0	0
13. The culture texts provide valuable information.	4.42	1.03	69	12	15	0	4
14. The system provides useful multi-lingual contents.	4.31	0.93	56	20	20	4	0
15. The system can boost my interest in learning local culture.	4.38	0.98	65	15	12	8	0

Interestingly, the highest mean scores and lowest SD scores for both groups were found in the item of educational effectiveness of the system, indicating that many respondents prioritize the educational function of the system. With strongly agree and agree being conflated, the findings showed that 94% (127/135) of adults and 96% (68/71) of non-adults highly agreed to the use of the robot technology to learn culture. People living in AI times are fond of accessing information with the new technology, so children or adults appreciate the educational function of the robot-mediated system. Their second highest level of satisfaction differs, with adults (93%; 126/135) opting for valuable culture information, and non-adults (92%; 65/71) for interesting culture texts. This finding reflects those adults are inclined to discover the educational value of culture texts, but non-adults tend to seek funny things to foster their learning interest.

With strongly agree and agree being conflated, the findings showed that adults (87%; 117/135) and non-adults (76%; 54/71) similarly had the lowest level of satisfaction with multi-lingual contents. This finding suggests that both groups think that two languages, Chinese and English, are adequate to transmit culture information. Totally, 91% (616/675) of adults and 85% (301/355) of non-adults hold an overall positive perspective (conflating strongly agree and agree) in their reflective assessments on the technological system when giving responses to the investigated items 11-15. The finding justifies that the system has imposed positive impacts on the respondents' cognitive reflections on the culture educational function of the robot-mediated system. The system design concurs with Norman's (2004) good reflective design—a pleasant reflective experience that is built up on the users' satisfaction with various aspects of a product. The author's on-site observations also support this point. Some users, particular children, used the system repeatedly. One child was reluctant to go home and watched others interacting with the robot. These findings prove that either adults or young children have satisfying experiences of using the system.

To sum up, many adults and non-adult respondents enjoy using the technological system to learn Taiwan culture, so the robot is functionally effective for public cultural education. The robot-mediated system has met Norman's (2004) three levels of emotional design—to attract users, to offer a pleasant operational experience, and to obtain positive cognitive reflections from users.

Implications of Culture Education Using the Technology

The present paper sheds light on the significant value of using the robot as an agent of culture education. The three areas of discovery derived from research findings are discussed in this section.

Educational Value of the Robot-Mediated System

The overall findings indicate that the two groups of respondents calculated together show a higher level of satisfaction with the investigated items 11-15 regarding educational effectiveness and significant value of the culture system (89%, 917/1030) than the investigated items 6-10 concerning the users' operational experience (84%, 862/1030) and the investigated items 1-5 pertaining to the robot's sensory appeal (77%, 797/1030). The findings suggest that for all respondents, of greater importance is the significant value and educational function of the robot-mediated system, not the robot's appealing outlook or operational performance. Although the robot has its strength of sensory appeal, users pay more attention to the value and characteristics of culture texts that are transmitted to the public. The majority of audiences interacting with the robot are eager to learn valuable or interesting culture information, e.g., the origins of the stories of local gods and symbolic meanings of some temple architectures. They expect to benefit from the educational function of the system. Thus, the educational significance of the robot-mediated system is not less important than its sensory attraction.

Robot-Accelerated Oblique Culture Education

Since 95 % (195/206) of both groups of respondents (conflating strongly agree and agree) show their positive position in assessing the educational effectiveness of the robot-mediated system, they have supported that culture education can be accelerated by using the robot technology. The value of robot-mediated culture education is reinforced after the robot has been recognized as a helpful tool to introduce merchandise information to customers at business venues. None is repulsed by a novel thing, so the robot is attractive. Once when users are emotionally attracted by the robot, they would accept the robot and learn culture knowledge from it. They might perceive the robot as an extension of the role of an instructor or a culture guide. Thus, the purpose of oblique culture education can be achieved through the implementation of the robot-mediated system.

Modification for Improvement

The results of the questionnaire-based survey support that the robot can physically, emotionally and cognitively engage the users in a public culture learning setting. What requires adjustments based on the findings is to provide two textual versions tailored to the users who have different levels of linguistic proficiency. The voice

of the robot can be fine-tuned to make it more natural like human's voice. Additionally, multi-lingual contents are not needed. Despite a small size of respondents, the findings have some referential value as they expose some defects for us to fix. It is expected that some modifications help the robot-mediated system more suitable for adult and non-adult users in the future.

Conclusion

In conclusion, adults and non-adults have their preferable items. In response to the robot's sensory appeal, more adults (84%; 570/675) show positive reactions (conflating strongly agree and agree) than non-adults (64%; 227/355) with a gap of 10%. In their responses to users' operational experiences, with strongly agree and agree begin conflated, still more adults (85%; 590/675) show their positive responses than non-adults (77%; 272/355) with a gap of 8%. The discrepancies indicate that many adult users enjoy an interaction with the robot, comprehend culture contents and follow the instructions clearly, but some young children do not. With regard to their reflective assessments on the value of the technological system, more adults (91%; 616/675) show their positive responses than non-adults (85%; 301/355) with a gap of 6%. The possible reason is that adults are aware of the importance of culture education, but many young children do not. The total findings show that the two groups of respondents are mostly divided in their motivations for using the system, but they mostly agree on the educational effectiveness of the technological system. The findings suggest that age is also a factor to affect the users' motivation, operational experiences and reflective assessments.

Culture education can be implemented using various media. This paper adds a new way of presentation for learning. Furthermore, the design of the robot-mediated system has complied with Norman's (2004) three levels of emotional design—to allow users to have immediate emotional attachment at the visceral level, to make users enjoy the performance of the product with delightful, pleasurable experiences at the behavioral level, and to affect users to assess the product as effective and memorable at the reflective level. Thus, the effectiveness of the technological system is confirmed. As artificial intelligence (AI) technology is emerging as a popular and trendy instrument, the robot can be used to achieve the goal of culture education.

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