Opinions regarding Virtual Reality among Older People in Taiwan

Diana Barsasella[1,2,3][a], Shwetambara Malwade[1], Chia-Chi Chang[4,5], Megan F. Liu[4], Sruthi Srikanth[6], Ajith Kumar Panja[7], Yu-Chuan Jack Li[1] and Shabbir Syed-Abdul[1,2]

[1]*International Center for Health Information Technology, Taipei Medical University, Taipei, Taiwan*
[2]*Graduate Institute of Biomedical Informatics, Taipei Medical University, Taipei, Taiwan*
[3]*Health Polytechnic of Health Ministry Tasikmalaya, Tasikmalaya, West Java, Indonesia*
[4]*School of Gerontology Health Management, College of Nursing, Taipei Medical University, Taipei, Taiwan*
[5]*College of Interdisciplinary Studies, Taipei Medical University, Taipei, Taiwan*
[6]*Department of Biomedical Engineering, College of Engineering, Guindy, Anna University, Chennai, India*
[7]*Department of Computer Science and Engineering, College of Engineering, Guindy, Anna University, Chennai, India*

Keywords: Elderly People, Virtual Reality, Technology Acceptance Model, Opinion.

Abstract: In recent years, older population aged 60 years and above has been increasing from 900 million in 2015 into 2 billion by 2050. With advancing age, older people experience decreasing social activities, decreased physical activities, issues related to mental health, disturbed sleep and overall poor quality of life. Virtual reality has shown applications in healthcare domain to help mitigate these problems. The aim of our study aim is to investigate the opinions of older population about virtual reality through dimensions of technology acceptance model. We used the data generated in our previously published research to measure the opinions of older population toward VR use. Thirty participants of older age group were involved in this study (twenty-four females and 6 males) from March to May 2018. They were exposed to 12 sessions of VR experiences for 15 minutes each, twice a week for 6 weeks. Kaiser-Meyer-Olkin measure of sampling adequacy and Bartlett's Test were conducted to test the reliability of each questions. From Likert scale analysis, positive opinions (more than 70%) were seen towards the use of VR for entertainment, raising mood, attractiveness and fun to use VR. While the highest choice showing negative opinions in the difficulty of learning to use VR (33.3%). Our study indicates the opinion of older population that they showed positive opinions for all of the TAM variables, the index being 72% to 78.44%. The perceived VR as enjoyable to use, but they still needed time to be skillful in using it. Our study showed that providing training and ease of use is an essential element while introducing VR among older adults.

1 INTRODUCTION

Older population aged 60 years and above has been increasing in number from 900 million in 2015 into 2 billion by 2050. Nowadays, the number of older people aged 80 years or older has reached 125 million (WHO, 2018). By 2030, older age group of Taiwan population will be 24% (Council ND, 2016).

As people grow older, they are prone to experience a decline in social activities. The issue has a higher impact among older adults staying in long-term care communities. They are often structurally and socially isolated. Moreover, older adults in long-term care communities are affected by dementia and depression (Lin et al, 2018; Harris-Kojetin et al, 2013). Currently, technology interventions are used as a support for isolation and loneliness. But it has shown mixed results in its effectiveness to provide social stimuli and enhance social interactions (Lin, 2018; Cotten et al, 2013; Miyazaki, 2013; Chao, 2015; Burmeister, 2016). Virtual reality (VR) as a computing technology can help to establish improved brain health in terms of cognitive functioning, neural efficiency and instrumental activities of daily living (Liao, Y. Y., 2019). VR reality system called Balance Rehabilitation Unit can be used to improve the balance and physical performance (Phu, S., 2019).

[a] https://orcid.org/0000-0002-6063-7711

Barsasella, D., Malwade, S., Chang, C., Liu, M., Srikanth, S., Panja, A., Li, Y. and Syed-Abdul, S.
Opinions regarding Virtual Reality among Older People in Taiwan.
DOI: 10.5220/0009425801650171
In *Proceedings of the 6th International Conference on Information and Communication Technologies for Ageing Well and e-Health (ICT4AWE 2020)*, pages 165-171
ISBN: 978-989-758-420-6

Virtual environments are interactive. The virtual image displays an enhanced version by special processing and by non-visual display modalities used to convince users that they are in a synthetic space (Ellis SR. 1994). For older population who are unable to travel or attend family events, can escape their isolation to a certain extent through virtual reality. Studies suggest that immersing older adults in virtual reality may stimulate the brain and reactivate some neuro-pathways by taking away distractions or serve as a distraction from confusion or pain (Adéla Plechatá, 2019). Thus, it is important to assess the opinions of older adults and their acceptance with regards to VR.

The Technology Acceptance Model (TAM) is often recognized as the foremost influential and commonly employed theory for describing an individual's acceptance of knowledge systems (Kai R. Larsen 2003). TAM was derived from the Theory of Reasoned Action (TRA) (Ajzen and Fishbein, 1980) and initially proposed by Davis (1986). TRA was a model focus on determinants of consciously intended behaviours. Behaviour is determined by their behavioural intention, which depends on attitude (A) and subjective norm (SN).

The rating scale is a term describing instruments to evaluate and use the item to select one value. Rating scales can be used to determine the attitudes and opinions, record direct observation and assessment. (Colton, 2007). Researchers feel comfortable making Likert items for their surveys because of their wide use. For the same reason, survey respondents are accustomed to and respond comfortably (Cooper, 2016). Researchers use a variety of rating scale formats with varying numbers of response categories and changing label formats to assess many dimensions of attitudes and opinions (Mary Lee Gregory 2015).

2 METHOD

Thirty participants were involved in this study (twenty-four females and six males) from March to May 2018. Participants were included if they were aged 60 years and older, those visiting the Taipei Medical University (TMU) aging center and agreed to be a participant in this research.

2.1 Data Collection

A research assistant explained the aims of the study to participants, following which they filled out and signed the consent form as an agreement to participate in the study. Participants were exposed to VR experiences, for two sessions a week and 15 minutes per session, for a period of 6 weeks. At the end of this duration, they were given the Mandarin Chinese version questionnaire aimed to collect the participant's opinion.

The questionnaire was based on Technology Acceptance Model (TAM) model (Davis et al, 1989) and variables proposed by Venkatesh. TAM is theory of information system derived from social psychology principles explaining technology acceptance behavior (Schnall & Bakken, 2011).

The reliability and validity of the questionnaire has been tested in our previously published research (Syed-Abdul, 2015), where the same responses were analyzed.

2.2 Data Analysis

Data was analyzed by using SPSS vers. 21 (SPSS. Chicago, II, USA). Correlation among the variables in the dataset was specified by Exploratory Factor Analysis (EFA).

One statistical approach to conduct factor analysis and to perform the EFA is Principal Component Analysis (PCA).

PCA is one of the approaches to conduct factor analysis and show variance proportion. High values of variables indicate well represented factor space, while the low values variables indicate unwell represented factor space. Varimax rotation was used to conduct the PCA from questionnaire to extract the factors. We conducted Kaiser-Meyer-Olkin measure of sampling adequacy (KMO) and Bartlett's test of sphericity. The measure of KMO could be varying between 0 and 1, and values closer to 1 are considered adequate. A value of .6 is a suggested as minimum. These two tests provide a minimum standard which should be passed before a PCA. KMO indicates the variance proportion in the variables caused by underlying factors. Factor analysis will be considered useful for the values that are close to 1.0, and not useful for the values less than 0.50 (Armentano, 2015).

Our questionnaire was scored on a 5-point Likert scale to measure the attitudes of older population in VR use. In this question, we determined 5 choices: 1. Strongly disagree, 2. Disagree, 3. Neutral, 4. Agree, and 5. Strongly Agree. Based on the responses, we produced the proportion of each answer, and the index and category for each variable (PU, PEOU, PE, SN, UE, IU) (Sullivan, 2013).

Table 1: Characteristics of participants.

Gender	Age				
	60-70	70-80	80-90	>90	
Male	4	2	0	0	6 (20%)
Female	11	10	2	1	24 (80%)
Total	15(50%)	12(40%)	2(6.7%)	1(3.3%)	

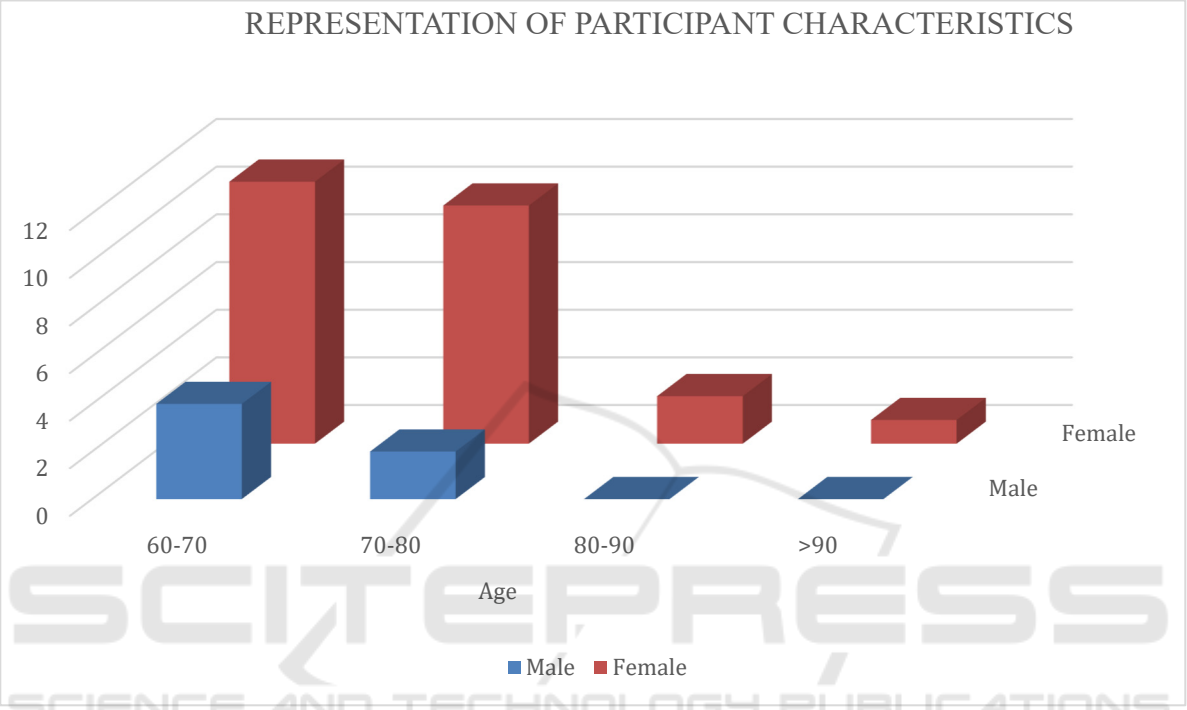

Figure 1: Participant Characteristics.

Table 2: KMO and Bartlett's Test.

KMO and Bartlett's Test		
Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		0.693
Bartlett's Test of Sphericity	P value	0.000

3 RESULT

Table 1 shows the characteristics of participants. The highest proportion (50%) of participants belonged to 60-70 years age range, with a majority of female participants (80%). The lowest proportion of participants belonged to >90 years age, comprising of one female participant (3.3%)

Table 2 shows KMO and Bartlett's Test result. KMO measure of sampling adequacy was 0.693, suggesting a moderately good index value. The p value from Bartlett's test of sphericity was 0.000. These results were indicative of the feasibility of PCA.

Table 3 shows the result of factor analysis with PCA. The range of values were 0.614 to 0.851, determining the sufficient interrelation of all variables. Table 4 indicates the details of the responses on the Likert scale. We found that more than 50% of the participants showed agreements in the positive opinions about VR, whereas 20.31% showed disagreements and 30.37% gave a neutral opinion.

Based on the figure 2 and table 4, we determined the result of the category for each variable in table 5. All the variables indicated agreement in PU, PEOU, PE, SN, UE, and IU to use VR, with a good index value ranging from 72% to 78.44%.

Table 3: Principal Component Analysis (PCA).

Item in Questionnaire	Extraction
VR is useful to me for entertainment.	0.716
VR improves engagement and motivates daily activities.	0.614
VR is an efficient tool to raise my mood.	0.690
It is easy for me to become skillful at using VR.	0.707
Learning to operate VR was easy for me.	0.851
Overall, I find it easy to use VR.	0.652
I find VR very attractive to use.	0.760
I enjoy using VR.	0.718
I have fun when I use VR.	0.780
My family members think I should use VR.	0.719
People who are friends and acquaintances have influence on my intention to use VR.	0.792
People who take care of me encourage me to use VR. (SN3)	0.651
VR will give me new experiences.	0.632
VR was comfortable to use.	0.778
Overall, I had a positive experience when using VR.	0.787
In the future, I intend to use the device for mental relaxation.	0.689
In the future, VR will help keep my mind sharp and alert.	0.755

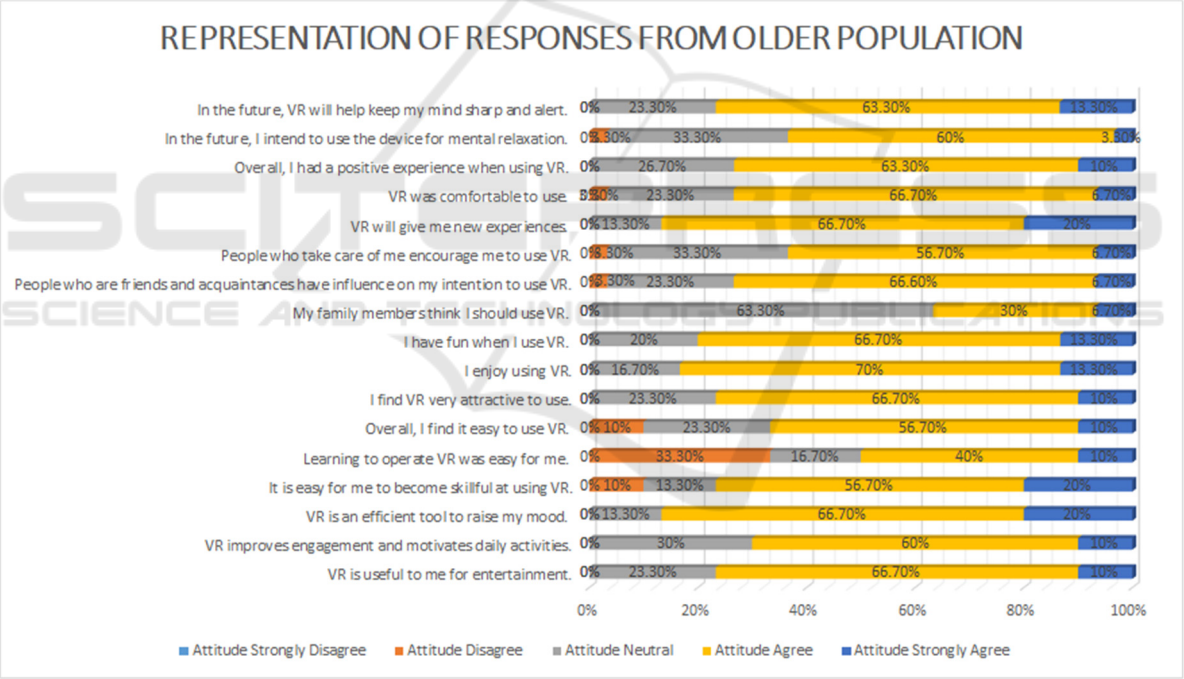

Figure 2: Representation of Responses from Older Population.

4 DISCUSSION

KMO of sampling acceptability is a statistic that indicates the percentage of variance within the variables that is probably due to underlying factors.Values close to 1.0 commonly suggest that factor analysis can be handy with the records since patterns of correlations are reasonably compact. Element analysis ought to yield fantastic and reliable factors. For values less than 0.50, the results of the element evaluation in all likelihood will not be beneficial (Armentano, 2015). The measured KMO is 0.693 from our data, which is undoubtedly an excellent index. It means that the sample is adequate and enough for this research and it doesn't need to

Table 4: Responses of older population.

Item in Questionnaire	Attitude				
	Strongly Disagree	**Disagree**	**Neutral**	**Agree**	**Strongly Agree**
VR is useful to me for entertainment.	0 (0%)	0 (%)	7 (23.3%)	20 (66.7%)	3 (10%)
VR improves engagement and motivates daily activities.	0 (0%)	0 (%)	9 (30%)	18 (60%)	3 (10%)
VR is an efficient tool to raise my mood.	0 (0%)	0 (%)	4 (13.3%)	20 (66.7%)	6 (20%)
It is easy for me to become skillful at using VR.	0 (0%)	3 (10%)	4 (13.3%)	17 (56.7%)	6 (20%)
Learning to operate VR was easy for me.	0 (0%)	10 (33.3%)	5 (16.7%)	12 (40%)	3 (10%)
Overall, I find it easy to use VR.	0 (0%)	3 (10%)	7 (23.3%)	17 (56.7%)	3 (10%)
I find VR very attractive to use.	0 (0%)	0 (%)	7 (23.3%)	20 (66.7%)	3 (10%)
I enjoy using VR.	0 (0%)	0 (%)	5 (16.7%)	21 (70%)	4 (13.3%)
I have fun when I use VR.	0 (0%)	0 (%)	6 (20%)	20 (66.7%)	4 (13.3%)
My family members think I should use VR.	0 (0%)	0 (%)	19 (63.3%)	9 (30%)	2 (6.7%)
People who are friends and acquaintances have influence on my intention to use VR.	0 (0%)	1 (3.3%)	7 (23.3%)	20 (66.6%)	2 (6.7%)
People who take care of me encourage me to use VR.	0 (0%)	1 (3.3%)	10 (33.3%)	17 (56.7%)	2 (6.7%)
VR will give me new experiences.	0 (0%)	0 (0%)	4 (13.3%)	20 (66.7%)	6 (20%)
VR was comfortable to use.	0 (0%)	1 (3.3%)	7 (23.3%)	20 (66.7%)	2 (6.7%)
Overall, I had a positive experience when using VR.	0 (0%)	0 (0%)	8 (26.7%)	19 (63.3%)	3 (10%)
In the future, I intend to use the device for mental relaxation.	0 (0%)	1 (3.3%)	10 (33.3%)	18 (60%)	1 (3.3%)
In the future, VR will help keep my mind sharp and alert.	0 (0%)	0 (0%)	7 (23.3%)	19 (63.3%)	4 (13.3%)

Table 5: Category and Index for each variable according to older population responses.

Item in Questionnaire	Variable	Index (%)	Category
VR is useful to me for entertainment.	Perceived Usefulness (PU)	78.22	Agree
VR improves engagement and motivates daily activities.			
VR is an efficient tool to raise my mood.			
It is easy for me to become skillful at using VR.	Perceived ease of use (PEOU)	72	Agree
Learning to operate VR was easy for me.			
Overall, I find it easy to use VR.			
I find VR very attractive to use.	Perceived Enjoyment (PE)	78.44	Agree
I enjoy using VR.			
I have fun when I use VR.			
My family members think I should use VR.	Social Norms (SN)	72.44	Agree
People who are friends and acquaintances have influence on my intention to use VR.			
People who take care of me encourage me to use VR. (SN3)			
VR will give me new experiences.	User Experience (UE)	77.77	Agree
VR was comfortable to use.			
Overall, I had a positive experience when using VR.			
In the future, I intend to use the device for mental relaxation.	Intention to Use (IU)	75.33	Agree
In the future, VR will help keep my mind sharp and alert.			

resample again. Bartlett's test of sphericity evaluates the speculation that the correlation matrix is a unit matrix, which specifies unrelated variables and is consequently not suitable for shape detection. For factor analysis to function, we require a few relationships between variables, and if the R-matrix is a unit matrix, then all correlations coefficients might be zero. (Armentano, 2015). For our data, Barlett's test is highly significant ($p<0.001$), and therefore, factor analysis is appropriate. It means all of the variables are suitable to use in this research to check the opinion on older population.

Extraction communalities estimates the variance of every variable considered for the factors in the factor solution. Small values indicate variables that don't match well with the factor solution and should presumably be dropped from the analysis (Armentano, 2015). The extraction communalities for our factors are acceptable, with the least value of 0.614 corresponding to PU (VR improves engagement and motivates daily activities). It indicates that variables are represented well in this research by every extracted component.

Older population selected the choice "agree" in 7 queries that suggest VR is useful to them for entertainment, VR is an efficient tool to raise their mood, find VR very attractive to use, have fun when they use VR, People who are friends and acquaintances have influenced the intention to use VR, VR will give new experiences, and VR was comfortable to use.

These seven questions indicate the attitude of agreement of the older population in using VR. While the highest choices answering Disagree was 10 (33.3%) founded in the question "Learning to operate VR was easy for me". 30% expressed difficulties in the use of VR. A majority showed neutral opinions and an easy opinion on the thoughts of family members to use VR. Our study used a similar rated scale to measure attitude with Hanne Huygelier et al.'s study.

Comparing with other research, the older population expressed positive and negative reactions for each VR variable, gave some preferences and opinions for improving the usability of the equipment, and identified facilitators and barriers that influenced usefulness. Recommendations for developing this technology include maximizing the positive aspects of VR through enlarging interactivity, helping them to socialize with friends or family, and enhancing older adults' ease of use. Desired content of simulations involved travel, continuing education, reminiscence, and self-care/therapy. This research is based on using TAM to process the acceptance of virtual reality. The methods used by the user to adopt this technology was analyzed meticulously, bringing in perceived enjoyment, social interactions, and power of the social ties to the basic TAM. The outcomes of this study indicate that social interactions and strength of the social relationships enhanced perseverance to enjoy. Perceived enjoyment has a higher significant effect on purpose to utilize than perceived usefulness, which is the importance of TAM. These outcomes have theoretical inferences for consumer adoption behaviour and empirical conclusions for the best marketing strategies for virtual reality devices (Robert et al, 2019).

5 CONCLUSION

Our study showed that older population expressed positive opinion for all of the TAM variables, the index being 72% to 78.44%. The highest agreement is PE and the lowest is PEOU. The older people perceived that it was enjoyable to use VR, but they still needed time to be skillful in using it. Future research should be more focused to provide a longer time duration and training to older population.

ACKNOWLEDGMENT

We would like to thank to the Research Center for Active Ageing, Taipei Medical University for facilitating the data collection of participants.

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