ORIGINAL ARTICLE

Effects of E-Learning Materials on Caregivers' Knowledge about the 3Ds of Geriatric Psychiatry

Raymund F. Mamayson, PhD, RN, Wyn P. Cawalo, Elliz John P. Morales, Rhomayne Xyla D. Morla, Kayla Louise M. Nebrida, Zia Marizz P. Orca, Leigh Shamaine R. Pacolor, Diana P. Paran, Alexandra Ysabelle P. Ramos, Ezra Nicole S. Razon, Ma. Marie Antonette C. Sales, Sir Josh Marlowe G. Soriano, Alexandra Krisha Danielle I. Tagorda and Rex Daniel B. Tingson

Nursing Program, School of Nursing, Allied Health, and Biological Sciences, Saint Louis University, Baguio City, Philippines

ABSTRACT

Background. E-learning has emerged as a crucial technique that educators embrace and apply. Two effective e-learning materials are video-based learning (VBL) and e-book-based remote learning (EBRL). While several studies have proven their effectiveness, none have compared these e-learning materials, especially regarding caregivers' knowledge of delirium, dementia, and depression (3Ds). Based on the extant literature, many caregivers are untrained and often lack the knowledge and skills to lessen the burden on delirious, demented, and depressed older adults. Hence, there is a growing need to explore how e-learning materials will address caregivers' lack of knowledge about the 3Ds of geriatric psychiatry.

Objectives. This study ascertained the effects of e-learning materials on caregivers' knowledge about the 3Ds of geriatric psychiatry and determined significant differences within and between groups.

Methods. A three-arm, quasi-experimental study, which included 63 informal caregivers in Baguio City who met the inclusion criteria and were chosen through purposive sampling, was conducted. Data were gathered using the Delirium-related knowledge tool, the Bangladesh version of the Depression Literacy Questionnaire, and the Dementia Knowledge Assessment Tool version 2. Data collection was done face-to-face and was conducted from March to April 2023. Data were treated with descriptive and inferential statistics using means, paired t-test, one-way omnibus ANOVA, and the post hoc Scheffé's test. Ethics approval was provided by the Saint Louis University Research Ethics Committee (SLU-REC-UG 2023-004).

Results. All the pretest mean scores of respondents in the VBL, EBRL, and control groups increased in the posttest. Additionally, the paired t-test revealed that the VBL and EBRL materials significantly affected the caregivers' knowledge about the 3Ds of geriatric psychiatry, evidenced by a t-statistic of -5.80 (p=0.00001) and -4.48 (p= 0.00023), respectively. Lastly, one-way ANOVA revealed that there was a statistically significant difference in mean scores between at least two groups (F(2,60) = [7.060], p=0.002). Post hoc analysis using Scheffé's test for multiple comparisons found that the mean values significantly differed between the VBL and the waitlist control group (Scheffé=10.589), and between the EBRL and the waitlist control group (Scheffé=10.589). There was no statistically significant difference between the VBL and the EBRL groups (Scheffé=0).

Conclusions. This study suggests that informal caregivers in Baguio City are moderately knowledgeable about the 3Ds of geriatric psychiatry. Moreover, both VBL and EBRL materials showed effectiveness in improving caregivers' knowledge about the 3Ds of geriatric psychiatry, highlighting the substantial equivalence of

eISSN 2094-9278 (Online)
Published: October 31, 2024
https://doi.org/10.47895/amp.vi0.8215

Corresponding author: Raymund F. Mamayson, PhD, RN
Nursing Program
School of Nursing, Allied Health, and Biological Sciences
Saint Louis University
Bonifacio Street, Baguio City, Philippines
Email: rfmamayson@slu.edu.ph
ORCiD: https://orcid.org/0009-0007-9910-5759

both materials. Lastly, caregivers' knowledge about the 3Ds of geriatric psychiatry increases as they engage in e-learning materials. Thus, it is acknowledged that VBL and EBRL materials are valuable, cost-effective, and practical interventions in improving caregivers' knowledge about the 3Ds of geriatric psychiatry.

Keywords: video-based learning, e-book-based remote learning, 3Ds, geriatric psychiatry, delirium, dementia, depression

INTRODUCTION

Online courses have grown significantly over the past years, making online or e-learning as common as today. Since the coronavirus disease-2019 (COVID-19) outbreak, online education has become more centric in people's lives as it has given people the flexibility to study remotely and provided them access to excellent teaching from the comfort of their homes. Hence, it is not unusual that participation in online courses has proliferated in recent years and will likely increase in the coming years.

Educators' primary pedagogical method to connect with and engage learners in online courses has been asynchronous text-based discussions for many years. According to Bates,[1] printed text has been a dominant teaching technology, arguably at least as influential as the teacher's spoken word. It was purported that even today, textbooks, mainly in printed format but increasingly in digital format, still play a significant role in formal education, training, and distance education. It is due to their ability to handle abstractions and evidence-based arguments and their suitability for independent analysis and critique.

Currently, it is posited that electronic books (e-books) are viral text-based learning media being used.[2] These materials have emerged as one of the many modern technological emergencies in introducing e-content more attractively and interactively, which has never been seen before through the traditional printed book.[3] As transformations from conventional textbooks to digital forms, e-books made it easy for students to search for available information.[2] Additionally, they made it easy to exchange information and data via the internet and mobile phones, allowing learners to use it for learning anytime and anywhere.

Undeniably, text-based learning media such as e-books have generally been treated as the default mode pedagogical method. The effectiveness of text-based learning media in academic teaching and learning has been studied, and authors have identified its many benefits. However, the 21st century has seen significant changes related to scientific discoveries, informatization, and globalization. The digital era has dawned upon men, and technology is quickly changing the educational landscape. Schools are changing, and so is learning. Hence, as the ways humans learn are changing, the methods and tools they use are also changing.

According to an article, before the COVID-19 pandemic, the limitations of text-based discussions led to an increasing number of online educators experimenting with synchronous web meetings using applications such as Zoom, WebEx, and Google Meet.[4] Through synchronous video-based discussions, immediacy, and social presence were established, the student's questions were addressed promptly, and problem-solving was better illustrated and demonstrated. However, notwithstanding these benefits, the COVID-19 pandemic has shown some limitations with synchronous meetings, including problems such as having eye strains to more complex ones involving various technical issues.

Such limitations of synchronous video meetings and asynchronous text-based discussions resulted in the exploration of alternatives among educators, where the use of asynchronous video-based lectures, or those videos that are recorded and then posted for viewing later by learners, have become a trend. Although this teaching strategy is not a definite remedy to address the limitations of asynchronous text-based discussions and synchronous video-based lectures, it has proven to be an effective instructional tool.[5,6]

On this premise, it is undeniable that e-learning has emerged as a crucial technique that educators, both locally and internationally, embrace and apply. Information and communication technology innovations have and continue to affect how education is delivered. For instance, video-based learning (VBL) which is a form of e-learning that allows the learner to acquire skills and knowledge through videos[7], as well as e-book-based remote learning (EBRL) where text information and images via book publications in digital form are presented, are being used on computers and other electronic devices by almost everyone. Both e-learning technologies enable users to learn with or without a facilitator or lecturer, thus, encouraging self-directed learning.[7] Both are effective instructional methods. However, while different studies have proven the effectiveness of video-based lectures[8] and e-books[9] as teaching-learning modalities, few studies have compared these e-learning technologies. This situation gives reason to conduct this study.

Specifically, with the increasing utilization of VBL and EBRL materials, the researchers aimed to explore how these e-learning materials address the lack of knowledge of informal caregivers about the 3Ds of geriatric psychiatry since, today, chronic, debilitating conditions are becoming quite common among the older population. The 3Ds of geriatric psychiatry, which include delirium, dementia, and depression, affect many older individuals worldwide. A rapidly growing number of older people globally have these conditions, which presents an unprecedented set of challenges to the nursing discipline.

According to Alagiakrishnan, delirium is a transient, usually reversible, cause of mental dysfunction that manifests clinically with a wide range of neuropsychiatric abnormalities.[10] Also, according to Echeverría et al., delirium typically appears in older people.[11] This is supported by a meta-analysis of 33 studies where it was found that it is

commonly seen among hospitalized older adults in general medical settings and that it has an overall delirium prevalence of 23%.[12]

Conversely, the World Health Organization (WHO) defines dementia as a syndrome in which there is a deterioration in cognitive function beyond what might be the usual consequences of biological aging.[13] In their report, the WHO posits that it is currently the seventh leading cause of death among all diseases and one of the significant causes of disability and dependency among older people globally. Additionally, it was reported that more than 55 million people live with dementia worldwide, and there are nearly 10 million new cases yearly. Also, Nagoor et al. found that 14.9% of 415 older adults in their study had dementia.[14]

The WHO defines depression as a common mental disorder affecting 5% of adults.[15] It is characterized by persistent sadness and a lack of interest or pleasure in previously rewarding or enjoyable activities. Patel et al. found that among 330 older adults, 25.8% had mild depression, 13.3% had moderate depression, and 17% had severe depression.[16] Similarly, Nagoor et al. found that among 415 older adults, 27.7% experienced depression.[14] Moreover, Zenebe et al. found a high prevalence rate of depression among the older age group.[17]

Indeed, many older individuals suffer from delirium, dementia, and depression, and these individuals are cared for by informal caregivers. Johns Hopkins Medicine defined informal caregivers as those who care for family or friends in a home environment, usually without payment.[18] Also known as family caregivers, they care for an aging parent, spouse, other relatives, an unrelated person, or an ill or disabled person. Because of this role, it is assumed that they know older people best. Some authors posit that they can relate to patients in ways that medical professionals cannot, as they frequently notice subtle changes in older people's cognition and behavior.[19] However, many caregivers are untrained and often lack the knowledge and skills to lessen the burden on older adults experiencing dementia, delirium, and depression.[20]

According to a needs assessment conducted in regional geriatric clinics in Ontario, Canada, informal caregivers perceived information as not readily available, as sources may be too simple, do not fit their learning style, or find the sources untrustworthy.[21] Thus, this leads to caregivers' lack of knowledge about managing people with dementia. Regarding delirium, Huang et al. stated that family caregivers were sailing in a "sea of perplexity" when they tried to understand the patient's episodes of delirium and make decisions about medical care.[22] Making decisions was perplexing due to a lack of knowledge about delirium and medical treatments. Some family caregivers even described delirium as a "weird" behavior because "no one had explained that speaking incoherently and moving uncontrollably were symptoms of delirium."

Regarding depression, it was found that education level affected how caregivers cared for their depressed older relatives.[23] In particular, caregivers with a higher educational level reported better quality of life than caregivers with a lower academic level. Hence, caregivers with higher educational levels understand depression more and can better cope with caregiving.

Based on these statistics, many caregivers find it hard to properly care for their delirious, demented, and depressed relatives. Hence, there is a growing need to explore how e-learning materials will address the lack of knowledge of the informal caregiver on the 3Ds of geriatric psychiatry. Despite extensive literature search, no studies have been found to have implemented educational materials to target the lack of knowledge about the 3Ds of geriatric psychiatry among informal caregivers.

With all said, the caregivers' lack of knowledge of the 3Ds of geriatric psychiatry is a cause for concern, especially because many older people are becoming affected by delirium, dementia, and depression. Since caregivers are the primary carers of older adults, providing them with knowledge about the 3Ds of geriatric psychiatry is a must. This scenario has to be attended to now more than ever. Thus, it now served as the primary motivation behind this study.

In particular, this study was conducted to establish the effects of two e-learning materials in improving caregiver knowledge about the 3Ds of geriatric psychiatry and determine significant differences within and between groups.

METHODS

Study Design

A three-armed, quasi-experimental study was conducted to establish the effects of a VBL and an EBRL material and ascertain if significant differences exist in the knowledge level of caregivers within and between groups.

Locale

Baguio City was the locale for this study. Mainly, the recruitment was conducted by going from house to house of known older individuals in Barangays Andres Bonifacio-Caguioa-Rimando, Aurora Hill Proper, Camp 7, Camp 8, Dontogan, East Quirino Hill, Engineers' Hill, Guisad Central, Irisan, Kayang Extension, Loakan Proper, Lower Quirino Hill, North Central Aurora Hill, San Luis Village, Santa Scholastica, South Central Aurora Hill, Teodora Alonzo, and Trancoville.

Sample Selection

The respondents were 63 family caregivers of older people in Baguio City, who were identified through purposive sampling and were invited to participate regardless of sex and socioeconomic status. They were all Filipino college graduates, caring for older people at home, have smartphones, laptops, or desktops, understands English, have no medical background, were not graduates of any medical or allied health programs, and were not currently enrolled in other research studies.

Additionally, they did not have severe visual impairments or profound hearing loss. Only one caregiver per household participated in the study.

The sample size was determined using the G*Power 3.1.9.7 program.[24] In anticipation of attrition, the researchers included 21 respondents per arm. Hence, a total of 63 respondents participated in the study. All participants provided informed consent.

Educational Materials

The study used an e-book and video-based learning material about delirium, dementia, and depression. The educational materials about the 3Ds of geriatric psychiatry contained information taken from open access, credible sources such as Medscape, Cleveland Clinic, Mayo Clinic, OPENMINDS Psychiatry, Counseling and Neuroscience Center, Healthdirect Australia, Memory and Aging Center, Medical News Today, Gerontology and Geriatric Medicine, National Institute on Aging, and the WHO.

The materials were subjected to a review by experts in gerontology and nursing research. In particular, evaluation was done to determine the suitability of the materials for college-level informal caregivers, using the Suitability Assessment of Materials (SAM)[25] questionnaire, where the materials were rated in terms of content, literacy demand, graphics, layout and type, learning stimulation and motivation, and cultural appropriateness. An overall score of 100% was computed after the review, meaning the materials were suitable.

The materials consisted of three modules, where one module each was developed for delirium, dementia, and depression. All the modules were organized so that an overview of the disease and the etiology, clinical manifestations, treatment and management, and follow-up care were presented and discussed.

Instrumentation

Three instruments with good psychometric properties were used to determine caregiver knowledge about the 3Ds of geriatric psychiatry. In particular, the delirium-related knowledge tool used in the study of Jung et al.,[26] the Dementia Knowledge Assessment Tool version 2 (DKAT2),[27] and the Bangladesh version of the Depression literacy instrument (Bangla D-Lit),[28] were used.

Permission to use the tool was received from the author of the DKAT2 tool. On the other hand, the tool that measures delirium-related knowledge was covered by the Creative Commons Attribution Non-Commercial License,[29] while the Bangladesh D-Lit was covered by the Creative Commons Attribution Non-Commercial No Derivatives License.[30]

Data Gathering Procedure

This study was a three-armed trial that commenced after ethics approval was received. Data gathering was done from March to April 2023. Initially, communication letters were sent to the barangay captains of the different barangays in Baguio City. Upon approval, the recruitment process started. Online recruitment posters were also posted on social networking sites like Facebook and Twitter. All interested informal caregivers were screened to ensure they met the eligibility criteria. All eligible respondents were subjected to consent-taking. Once informed consent was taken, the respondents were subjected to a pretest using the instruments to determine their baseline scores. The screening, consent-taking, and pretesting procedure were done face-to-face.

Once pretesting was done, the respondents were assigned to the VBL, EBRL, and the waitlist control groups. The respondents were given a number that served as their identifier. A single-blind protocol was implemented where the respondents in each group were unaware of the interventions the other groups received.

The respondents assigned to the VBL group underwent a 2-week intervention program where they had to engage in a video-based intervention. The researchers saved the video file on the respondents' cellphones, laptops, or desktops. The respondents were then instructed to open the file to access the video about delirium, dementia, and depression. They were instructed not to search for information about the 3Ds of geriatric psychiatry actively.

Simultaneously, the respondents assigned to the EBRL group underwent a 2-week intervention program where they had to engage in the e-book-based remote learning intervention. The researchers saved the document file on the respondents' cellphones, laptops, or desktops. The respondents were then instructed to open the file to access the e-book about delirium, dementia, and depression. They were instructed not to search for information about the 3Ds of geriatric psychiatry actively.

Short message service or call reminders were sent to all respondents during the fifth and 10th days to remind them of the need to engage in the video-based and e-book-based intervention. On the 14th day, the researchers met with the respondents and administered a posttest using the instruments.

Lastly, respondents assigned to the waitlist control group were instructed to engage in their usual activities. The researchers instructed the respondents to avoid searching for information about delirium, dementia, and depression. On the 14th day, the researchers administered a posttest using the instruments. The waitlisted respondents were then allowed to choose between the interventions. The video and document files were saved in the waitlisted respondents' cellphones, laptops, or desktops.

Statistical Treatment

Descriptive and inferential statistics were used. The data gathered through the questionnaire were checked to determine the overall knowledge score and the scores relating to delirium, dementia, and depression. Mean scores were computed. The highest possible overall knowledge score was 66, while the highest score for delirium, dementia, and

depression was 25, 21, and 20, respectively. The higher the scores, the higher the level of knowledge.

The paired *t*-test was used to determine the effects of the e-learning materials on caregivers' knowledge about the 3Ds of geriatric psychiatry. Meanwhile, the one-way Analysis of Variance (ANOVA) was used to determine whether there were any statistically significant differences between the posttest means of the three study arms. However, since the one-way ANOVA could not determine which specific groups were statistically significantly different from each other, a post hoc analysis was conducted using the Scheffé test.

The researchers performed the computations manually. All values were validated using the Data Analysis ToolPak of Microsoft Excel 2019 and MedCalc® Statistical Software version 20.305.[31]

Ethical Considerations

This study was conducted according to the guidelines stipulated in the Declaration of Helsinki. All procedures involving human respondents were approved by the Saint Louis University Research Ethics Committee (protocol number SLU-REC-UG 2023-004). Additionally, emphasis was placed on protecting the respondents' rights, enhancing research validity, and maintaining scientific and academic integrity by upholding the ethical principles of respect for autonomy, beneficence, non-maleficence, and justice.

RESULTS

Upon using the questionnaires to determine knowledge of delirium, dementia, and depression, a pretest mean score of 12.19 (Moderately Knowledgeable), 9.48 (Moderately Knowledgeable), and 9.48 (Moderately Knowledgeable), respectively, increased to 18.43 (Highly Knowledgeable), 13.48 (Moderately Knowledgeable), and 12.19 (Moderately Knowledgeable) after engaging in the video-based intervention. Conversely, a delirium-related knowledge mean score of 15.76 (Moderately Knowledgeable), dementia-related knowledge mean score of 10.14 (Moderately Knowledgeable), and depression-related knowledge mean score of 8.71 (Moderately Knowledgeable), increased to 19.29 (Highly Knowledgeable), 12.86 (Moderately Knowledgeable), and 11.95 (Moderately Knowledgeable), after engaging in the e-book-based intervention. Lastly, the respondents' delirium, dementia, and depression-related knowledge pretest mean scores were 13.48, 9.67, and 9.33, respectively. These scores increased to 15.57, 11.52, and 9.24 after two weeks. All pretest and posttest mean scores of the waitlisted respondents were interpreted as moderately knowledgeable. Table 1 shows the pretest and posttest mean scores of the respondents in each group, with the respective interpretation and the mean differences.

In the video-based learning group, an overall pretest mean score of 31.14 (Moderately Knowledgeable) was computed, which increased to 44.10 (Highly Knowledgeable) in the posttest. In the e-book-based learning group, an overall pretest mean score of 34.62, interpreted as Moderately Knowledgeable, increased to 44.10 (Highly Knowledgeable). Lastly, in the waitlist control group, an overall pretest mean score of 32.48 (Moderately Knowledgeable) increased to 36.33 (Moderately Knowledgeable) in the posttest. Upon using the paired *t*-test to determine significant differences between the pretest and posttest means in the video-based, e-book-based, and waitlist control groups, a *t*-statistic of -5.80 (p=0.00001), -4.48 (p= 0.0002), and -2.23 (p=0.037), were computed, respectively. The null hypotheses were rejected. Thus, both video-based and e-book-based learning materials have a statistically significant effect in improving caregiver

Table 1. Observed Pretest and Posttest Mean Scores and Mean Differences of Respondents in the Three Study Arms

3Ds of Geriatric Psychiatry	Video-based Learning (Experimental Group A)			E-Book-based Learning (Experimental Group B)			Waitlist Control		
	Pretest Mean (Interpretation)	Posttest Mean (Interpretation)	Mean Difference	Pretest Mean (Interpretation)	Posttest Mean (Interpretation)	Mean Difference	Pretest Mean (Interpretation)	Posttest Mean (Interpretation)	Mean Difference
Delirium	12.19 (M)	18.43 (H)	6.24	15.76 (M)	19.29 (H)	3.53	13.48 (M)	15.57 (M)	2.09
Dementia	9.48 (M)	13.48 (M)	4.00	10.14 (M)	12.86 (M)	2.72	9.67 (M)	11.52 (M)	1.85
Depression	9.48 (M)	12.19 (M)	2.71	8.71 (M)	11.95 (M)	3.24	9.33 (M)	9.24 (M)	0.09

Mean Delirium Scores
16.67-25.00 Highly Knowledgeable (H)
8.34-16.66 Moderately Knowledgeable (M)
0.00-8.33 Somewhat Knowledgeable (S)

Mean Depression Scores
13.33-20.00 Highly Knowledgeable (H)
6.67-13.32 Moderately Knowledgeable (M)
0.00-6.66 Somewhat Knowledgeable (S)

Mean Dementia Scores
14.01-21.00 Highly Knowledgeable (H)
7.01-14.00 Moderately Knowledgeable (M)
0.00-7.00 Somewhat Knowledgeable (S)

Table 2. Paired Samples t-Test Results Comparing Overall Pretest and Posttest Means

	Pretest Mean (Interpretation)	Posttest Mean (Interpretation)	Mean Difference	*t*	*p*
Video-based Learning (Experimental Group A)	31.14 (M)	44.10 (H)	12.96	-5.80	0.00001*
E-Book-based Learning (Experimental Group B)	34.62 (M)	44.10 (H)	9.4	-4.48	0.0002*
Waitlist Control	32.48 (M)	36.33 (M)	3.85	-2.24	0.037*

Mean Overall Scores
44.01-66.00 Highly Knowledgeable (H)
22.00-44.00 Moderately Knowledgeable (M)
0.00-22.00 Somewhat Knowledgeable (S)

** value significant at <0.05*

Table 3. Analysis of Variance (ANOVA) Summary Table

Study Arm	Mean	F	*p*	Scheffé	Scheffé's Critical Value
Video-based Learning (Experimental Group A)	44.095	7.060	0.002*	10.589**	6.30
E-Book-based Learning (Experimental Group B)	44.095			10.589**	
Waitlist Control	36.333			0	

** value significant at <0.05; ** value significant if exceeding Scheffé's Critical Value*

knowledge about the 3Ds of geriatric psychiatry. Also, there is a significant difference in the pretest and posttest scores of the waitlisted respondents. Table 2 illustrates the overall pretest and posttest mean scores in each group, the mean differences, and the *t*-statistic with the corresponding *p*-values.

A one-way ANOVA was performed to compare the posttest means of the three study arms. The one-way ANOVA revealed that there was a statistically significant difference in mean scores between at least two groups (F(2,60) = [7.060], *p*=0.002). The null hypothesis was rejected. Therefore, there is a significant difference in the mean scores between groups. Post hoc analysis using Scheffé's test revealed a Scheffé critical value of 6.30. Scheffé's test for multiple comparisons found that the mean values significantly differed between the VBL and the waitlist control group (Scheffé=10.589), and between the EBRL and the waitlist control group (Scheffé=10.589). There was no statistically significant difference between the VBL and the EBRL groups (Scheffé=0). Table 3 shows the posttest means of the three study arms, the F-statistic, the *p*-value, and the value of Scheffé per comparison compared to the critical value.

DISCUSSION

Video-based Learning and Knowledge of the 3Ds of Geriatric Psychiatry

The findings may be attributed to the benefits of video-based interventions in general. According to Afify, video materials inspire and engage learners, provide authentic learning experiences, foster mastery of learning by reducing cognitive overload and maximizing retention, facilitate problem-solving, and promote self-directed learning.[32] The VBL material used in this study did just that. The caregivers were inspired and became more engaged in learning, knowing they would benefit from the intervention. The VBL was also designed to give caregivers a simple and practical learning experience while promoting self-directed learning. Hence, it helped retain information about delirium, dementia, and depression.

These benefits of using video materials are also supported by research that shows that VBL has been an effective way to improve knowledge about understanding the course material and their performance on the assessment.[33] Behesti et al. posit that VBL is a powerful educational approach to enhance learning results, increase learners' satisfaction, and increase student engagement and motivation, leading to better learning outcomes.[34] Additionally, video-based interventions can be accessed at any time and place, providing greater flexibility and convenience for learners and increasing satisfaction with the learning experience.[35] Lastly, according to Fang et al., VBL helps reduce cognitive load, grabs viewer attention, and increases learner engagement.[36]

Concerning the E-learning Theory,[37] some principles were embedded in the video. The multimedia and modality principles helped enhance the capability of the respondents to learn just by simply listening and seeing visuals explained through audio narration instead of using text. Avoiding irrelevant information under the coherence principle and describing the topic using audio narration only, rather than using both audio narration and text under the redundancy principle, prevented the subjects from suffering from the

information overload that can hinder them from learning efficiently. The pre-training and segmenting principles were applied since the researchers explained the key concepts before discussing the specific topics. Moreover, each topic was segmented to manage complicated contents, preventing confusion among the subjects. The personalization principle was also applied since the researchers used a conversational tone and practiced pausing while delivering information to highlight important points. This strategy made the respondents more engaged in the intervention. Lastly, the researchers allowed the respondents to decide where and what time they would like to watch the video, applying the learner control principle where the respondents fully control their self-directed learning.

Regarding the cognitive load mentioned in the E-learning Theory,[37] this study used a VBL material to decrease the extraneous load and manage germane and intrinsic cognitive load, improving caregiver knowledge about the 3Ds of geriatric psychiatry. This finding resonates with the results of Costley et al., where it was purported that instruction should ideally be presented to decrease the extraneous cognitive load and improve germane load.[38] By using specialized video lecture viewing techniques to manage the information flow, respondents may be able to manage extraneous load more successfully.

On another note, the VBL material used audio and visual formats without on-screen text. This strategy prevented cognitive overload among the respondents, which increased their posttest scores. This finding is supported by the propositions of the Dual Coding Theory that information presented in visual and auditory formats is more likely to be remembered than information presented in only one form.[39] Moreover, when data is presented in both visual and auditory formats, it is processed in both verbal and non-verbal channels, leading to more effective encoding and retrieval since the two channels provide complementary information. The combination of the two formats provides more cues for memory retrieval.

Lastly, it appears that motivation is a factor that might have swayed the results. In the study of Harandi, it was said that motivation plays a mediating role in the relationship between engagement with video lectures and achieving learning objectives.[40] Based on observations and informal dialogues with the respondents, they were motivated to learn new information since they knew they would benefit from the intervention and could apply it to their real-life situations as informal caregivers. However, the respondents' motivation might have been influenced by their preferences and individual differences, which were not explored since it was not the study's goal. Thus, explaining the results based on motivation alone warrants caution.

In sum, given that video-based interventions generally have many benefits and that the VBL material used in this study effectively improved caregiver knowledge about the 3Ds of geriatric psychiatry, healthcare professionals can translate the study results into nursing practice. In particular, they can include the use of VBL materials in their care plans. Using video-based lectures about the 3Ds of geriatric psychiatry or any other topic, the visual and auditory content is expected to increase information retention among the learners. Additionally, using pre-recorded videos about specific topics facilitates self-directed learning while giving the nurse more time to perform other patient care-related tasks.

E-Book-based Learning and Knowledge of the 3Ds of Geriatric Psychiatry

With the revolutionary teaching and learning in the 21st century, technology has been noted to play one of the most crucial roles in advancing educational systems.[41] Such technology includes the use of e-books which are electronic formats of publications that were suggested as able to replace traditional printed books to support students' reading comprehension development.[42] Also, some researchers pointed out that e-books can enhance students' access to information and provide varied uses and advantages, which include easy accessibility, search capability, translation options, text sharing, cutting and pasting, currency, space-saving, portability, online referencing, and being environmentally friendly.[43]

The e-book used in the study facilitated learning among the respondents because of the uses, as mentioned earlier, and advantages of e-books. First, the respondents found navigating to a specific content easy, increasing time efficiency. This idea is supported by the findings of Al-Qatawneh et al.,[41] where it was found that students considered this feature very important and helpful while using e-textbooks. The statement "The e-textbook gives me the ability to rapidly search and access any text for specific content, a word, part of the text or certain pages" was a finding of the study. Second, it was concluded in a study by Rahim et al. that e-books are very effective in learning.[44]

Additionally, digital books using the portable document format (PDF) are easy to use and make it easier to process security. In this study, the e-book was saved as PDF. This strategy made it easy for the respondents to use the e-book about the 3Ds of geriatric psychiatry. In addition, the ability to highlight or write on the PDF has contributed to increased respondents' knowledge about the 3Ds of geriatric psychiatry. This finding is supported by a study that found that attitude towards the utilization of e-books is significantly impacted by perceived ease of use and that the unique features of e-books, such as bookmarking, highlighting, annotating, zooming, page flipping, and navigating, improve the learners' note-taking abilities.[45]

Concerning the E-Learning Theory,[37] some principles were applied to the e-book to manage germane and intrinsic load, thus, improving the respondents' knowledge about the 3Ds of geriatric psychiatry. The information in the e-book was presented using text and graphics. Additionally, all data were screened. Hence, only relevant information was included and aligned with the images. Moreover, information was presented

in segments, making it easy to comprehend. Key concepts were also explained in the preface of the e-book. On top of this, annotations like using bold texts to emphasize concepts were used. Lastly, the learners were allowed to control the pace of their learning. All these were applications of the multimedia, contiguity, segmenting, pre-training, signaling, and learner control principles, respectively.

The findings of this study may also be explained by the propositions of the Literacy Processing theory by Marie Clay. According to some authors, Clay has referred to her theory as "complex," where it was suggested that learners construct an operating system as they engage in reading and writing.[46] Concerning the study, it implies that as the respondents were exposed to the e-book's contents, their simple understanding and knowledge about the 3Ds of geriatric psychiatry increased as opportunities for them to have improved complex knowledge progressed through the construction of a literacy processing system that integrates linguistic, perceptual, and cognitive information sources.

Similarly, the findings of this study may be explained by the concept of intrinsic motivation, which is a concept that plays an essential role in the Self-Determination Theory.[47] Intrinsic motivation refers to the performance of an activity for its inherent satisfaction rather than obtaining a tangible reward or avoiding a punishment. The theory emphasizes the fulfillment of fundamental human needs for autonomy or feeling in control of their behavior, competence, which refers to the mastery of tasks and learning different skills, and relatedness, which addresses the need to experience a sense of belongingness. While the respondents might have been motivated by extrinsic rewards such as having a copy of the e-book, it is highly possible that they were highly interested and enjoyed reading the e-book. In fact, during the intervention period, some of the respondents verbalized: *"Maganda iyong e-book ninyo at kumpleto ito, kaya magandang basahin;" "Maganda iyong e-book. Pwede ko ba siyang i-share sa mga kamag-anak ko?"* These verbatims are clear examples of intrinsic motivation.

Overall, using an e-book increases knowledge about the 3Ds of geriatric psychiatry, and data from the extant literature may explain its effects. This finding suggests that nurses, especially academicians, can use e-books to deliver relevant content. Nurse practitioners and student nurses may use e-books in clinical and community practice, such as when conducting health education sessions in the hospital or sitio classes in the community. Lastly, nurses in geriatric wards can use e-books about the 3Ds of geriatric psychiatry to raise awareness among informal caregivers.

Waitlist Control

The familiarity principle, also called the mere-exposure effect, may explain this finding. The familiarity principle refers to the tendency for a person to remember and develop a preference for the things they are familiar with. In this study, the respondents were exposed to the questionnaire twice. The respondents were given the same questions for the pretest and the posttest, a form of repeated exposure. According to Palumbo et al.,[48] repetition may carry a positive connotation and may affect memory. Thus, it can only be assumed that being exposed twice to the items in the questionnaire swayed the respondents' preferences and eventually influenced the results.

Moreover, the results may be explained by the concept of retrieval practice, which refers to deliberately recalling information to pull knowledge out and provide opportunities for examination. One study found that taking practice tests, even without feedback or additional study time, led to better long-term retention of the information compared to restudying the material.[49] Another study found that taking a pretest that requires more significant retrieval effort can enhance memory retention, even without feedback or learning material.[50] This effect is thought to occur because retrieval practice strengthens the memory trace, making it easier to retrieve the information later on. Specifically, the study found that respondents who took a pretest with difficult cue words that required more retrieval effort had better recall of the target words than those who took a pretest with easy cue words that required less retrieval effort. This effect may have influenced the present study. It can only be assumed that the waitlisted respondents were unfamiliar with some phrases in the questionnaire. This unfamiliarity may have required more retrieval effort, thus, promoting memory retention. The information retained was recalled in the posttest, resulting in a higher score.

Lastly, the findings of this study may be attributed to the search for information, which was beyond the control of the researchers. Despite setting a contract and informing them not to search for information about delirium, dementia, and depression actively, the respondents might have searched for information, especially the terms they encountered in the pretest that were unfamiliar to them. Applying the concept of metacognition, which refers to the ability to reflect on and monitor one's thinking and learning processes, the waitlisted respondents might have reflected and felt a lack of knowledge about the 3Ds of geriatric psychiatry. Such feelings may have stimulated them to search for information actively. Thus, getting high scores in the posttest.

All in all, the increase in the knowledge about the 3Ds of geriatric psychiatry among the waitlisted respondents resulted from the lack of control of extraneous variables. This finding suggests that extraneous variables, such as the search for information, familiarity, and retrieval practice, are confounding variables that should be controlled in future research.

Significant Differences between the Means of the Three Study Arms

These results revealed greater improvement in caregivers' knowledge about the 3Ds of geriatric psychiatry among the respondents in the experimental groups, namely VBL and EBRL groups, compared to the waitlist control group. This

evidence of effectiveness is due to the factors mentioned above, such as the benefits of video-based lectures and e-books in general, the application of the principles stated in the E-Learning Theory, the prevention of cognitive overload as explained by the Dual Coding Theory, the assemblage of a system of perceptual and cognitive competencies as described by the Literacy Processing Theory, and the mediating role of intrinsic motivation as explained through the Self-Determination Theory.

In summary, this study found that caregivers' knowledge about the 3Ds of geriatric psychiatry increased because of the effects of video and e-book-based educational materials about delirium, dementia, and depression. There were no differences in the posttest mean scores of respondents in the VBL and the EBRL material, which means that the materials are equally effective in improving caregiver knowledge about the 3Ds of geriatric psychiatry. Thus, healthcare professionals, especially nurses, may use any of the two interventions to enhance learning for caregivers and all stakeholders, including doctors, nurses, unions, the government, patients, and communities.

Strengths and Limitations

Conducted as an experimental study that generates a specific result, this study was believed to be the first to explore the knowledge of informal caregivers regarding the 3Ds of geriatric psychiatry in a Filipino context. This experimental study's strengths include using reminders, including a sample for experiments greater than the recommended number, using video and e-book interventions of good quality, and the quantitative pooling of data and analysis using established statistical methods. Reminders were sent every five days to ensure the respondents remained engaged with the interventions. Also, this study used 21 respondents per arm, which exceeded the expected minimum number of 15 respondents in each group. Furthermore, the educational materials used in the study underwent validation using the SAM questionnaire, emphasizing factors affecting readability and comprehension. Lastly, the data gathered underwent rigorous statistical analysis.

Conversely, just like other experimental studies, the limitations of this study are the short duration of the intervention period and the inability to control certain factors, such as the time when the respondents engaged with the intervention. This study implemented a two-week intervention period which might have been too short to fully establish the long-term effects of the interventions on the respondents' knowledge of the 3Ds of geriatric psychiatry. Also, the study only included college graduates. Moreover, matching was not done to ensure that the respondents were comparable at baseline entirely. While the researchers could have possibly addressed confounding variables by restricting the sample, in the sense that they have the same value of potential confounding variable, it was still decided that matching be discontinued and accept the lack of it as a limitation, rather than restricting the sample where only respondents of the same sex or age were included in the study. Lastly, the researchers could not control the time the respondents engaged in the interventions because of schedule conflicts and their access to information during the intervention period.

Despite the abovementioned strengths, caution in interpreting the current findings is warranted. Nonetheless, even if the study only included college-level informal caregivers, most caregivers nowadays are college graduates, making the results generalizable to the caregiver population.

CONCLUSIONS AND RECOMMENDATIONS

This experimental study suggests that informal caregivers in Baguio City are moderately knowledgeable about the 3Ds of geriatric psychiatry. Moreover, both VBL and EBRL materials showed evidence of effectiveness in improving caregiver knowledge about the 3Ds of geriatric psychiatry. This evidence of effectiveness highlights the substantial equivalence of both e-learning materials regarding knowledge enhancement. Lastly, compared to not receiving any educational intervention, caregivers' knowledge about the 3Ds of geriatric psychiatry increases as they engage in e-learning materials. Thus, it is acknowledged that video-based and e-book-based materials are valuable, cost-effective, and practical interventions in improving caregivers' knowledge about the 3Ds of geriatric psychiatry.

The study's result provides insight into the effects of video-based lectures and e-book-based content in improving knowledge about the 3Ds of geriatric psychiatry. Nurses who work in various settings can consider translating the results of this study into nursing practice. In particular, it is recommended that nurses use video and text-based materials when conducting health education sessions, both in the hospital and in the community.

For nursing research, it is recommended that nurse researchers consider conducting further studies about the comparative effectiveness of a VBL and an EBRL material, which focuses on other topics aside from the 3Ds of geriatric psychiatry. It is recommended that researchers who would want to explore more on the matter should widen the study's scope. In particular, researchers may consider conducting longitudinal studies with a broader locale, a more extended intervention period, and the conduct of tracking tests to determine subsequent effectiveness. Lastly, researchers should also consider conducting true experimental studies using random assignment of respondents into study arms and more control on extraneous variables that might affect the results.

For nursing education, it is recommended that agencies involved in information dissemination conduct more education campaigns on any topic using video and text-based educational materials. It is also recommended that this study's results be integrated into the undergraduate and graduate nursing programs. Video and text-based materials allow

learners to remain engaged, especially when the materials fit their learning styles. As a result, they learn more about the topic, making them more competent in meeting healthcare demands and achieving better patient outcomes.

Statement of Authorship

All authors certified fulfillment of ICMJE authorship criteria.

Author Disclosure

All authors declared no conflicts of interest.

Funding Source

This study was self-funded.

REFERENCES

1. Bates AW. 7.2 Text. In: Bates AW, editor. Teaching in a Digital Age: Guidelines for Designing Teaching and Learning [Internet]. Vancouver: Tony Bates Associates Ltd.; 2015 [cited 2023 Sep 13]. p. 255-60. Available from: https://opentextbc.ca/teachinginadigitalage/.
2. Budi Santoso TN, Siswandari S, Sawiji H. The effectiveness of eBook versus Printed Books in the rural schools in Indonesia at the modern learning era. Int J Educ Res Rev. 2018 Oct 1;3(4):77–84. doi: 10.24331/ijere.453512.
3. Ebied MMA, Rahman SAA. The effect of interactive e-book on students' achievement at Najran University in computer in education course. J Educ Pract [Internet]. 2015 [cited 2022 Nov 5];6(19):71–82. Available from: https://files.eric.ed.gov/fulltext/EJ1079544.pdf
4. Lowenthal P, West R, Archambault L, Borup J. Engaging students through asynchronous video-based discussions in online courses [Internet]. 2020 Aug 24 [cited 2022 Nov 22]. Available from: https://er.educause.edu/articles/2020/8/engaging-students-through-asynchronous-video-based-discussions-in-online-courses
5. Mendoza GLL, Caranto LC, David JJT. Effectiveness of video presentation to students' learning. Int J Nurs Sci. 2015;5(2):81–6. doi: 10.5923/j.nursing.20150502.07.
6. Nikopoulou-Smyrni P, Nikopoulos C. Evaluating the impact of video-based versus traditional lectures on student learning. Educ Res [Internet]. 2010 Sep [cited 2022 Nov 3];1(8):304–11. Available from: https://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.426.4675&rep=rep1&type=pdf
7. Sutirman S. The differences in the effect of using video and modules as media in learning electronic record management. TEM J. 2019 Aug;8(3):984-91.. doi: 10.18421/TEM83-41.
8. Cheristiyanto C. The effectiveness of video-based learning media to increase student economic learning outcomes during the COVID-19 Pandemic. Econ Educ Anal J. 2021 Oct 30;10(3):394–403. doi: 10.15294/eeaj.v10i3.47899.
9. Misbah M, Khairunnisa Y, Amrita PD, Dewantara D, Mahtari S, Syahidi K, et al. The effectiveness of introduction to nuclear physics e-module as a teaching material during COVID-19 pandemic. J Phys. 2021 Jan;1760:012052. doi: 10.1088/1742-6596/1760/1/012052.
10. Alagiakrishnan K. Delirium [Internet]. 2019 Apr 25 [cited 2022 Oct 24]. Available from: https://emedicine.medscape.com/article/288890-overview
11. Echeverría MD, Schoo C, Paul M, Doerr C. Delirium (Nursing) [Internet]. 2022 Nov 19 [cited 2022 Dec 2]. Available from: https://www.ncbi.nlm.nih.gov/books/NBK568723/.
12. Gibb K, Seeley A, Quinn T, Siddiqi N, Shenkin S, Rockwood K, et al. The consistent burden in published estimates of delirium occurrence in medical inpatients over four decades: a systematic review and meta-analysis study. Age Ageing. 2020 Apr 27;49(3):352-60. doi: 10.1093/ageing/afaa040. PMID: 32239173; PMCID: PMC7187871.
13. World Health Organization. Dementia [Internet]. 2022 Sep 20 [cited 2022 Oct 21]. Available from: https://www.who.int/news-room/fact-sheets/detail/dementia
14. Nagoor K, Darivemula SB, Reddy NB, Patan SK, Deepthi CS, Chittooru CS. Prevalence of mental illness and their association with sociodemographic factors in the rural geriatric population in Chittoor, Andhra Pradesh, India: A community-based study. J Educ Health Promot. 2018 Dec 28;7:165. doi: 10.4103/jehp.jehp_193_18. PMID: 30788375; PMCID: PMC6333028.
15. World Health Organization. Depression [Internet]. 2019 [cited 2022 Oct 21]. Available from: https://www.who.int/health-topics/depression#tab=tab_1
16. Patel M, Bhardwaj P, Nebhinani N, Goel AD, Patel K. Prevalence of psychiatric disorders among older adults in Jodhpur and stakeholders perspective on responsive health system. J Family Med Prim Care. 2020 Feb 28;9(2):714-20. doi: 10.4103/jfmpc.jfmpc_1016_19. PMID: 32318408; PMCID: PMC7113956.
17. Zenebe Y, Akele B, W/Selassie M, Necho M. Prevalence and determinants of depression among old age: a systematic review and meta-analysis. Ann Gen Psychiatry. 2021 Dec 18;20(1):55. doi: 10.1186/s12991-021-00375-x. PMID: 34922595; PMCID: PMC8684627.
18. Johns Hopkins Medicine. Being a Caregiver [Internet]. 2022 [cited 2022 Oct 14]. Available from: https://www.hopkinsmedicine.org/health/caregiving/being-a-caregiver
19. McKenzie J, Joy A. Family intervention improves outcomes for patients with delirium: Systematic review and meta-analysis. Australas J Ageing. 2020 Mar;39(1):21-30. doi: 10.1111/ajag.12688. PMID: 31250961.
20. Alexander K, Gangai NC, Manna R, Korc-Grodzicki B. Educational initiative for minority community caregivers on geriatric syndromes. Innov Aging. 2018 Nov 1;2(Suppl 1):11-2. doi: 10.1093/geroni/igy023.039. PMCID: PMC6226693.
21. Ringer TJ, Wong-Pack M, Miller P, Patterson C, Marr S, Misiaszek B, et al. Understanding the educational and support needs of informal care-givers of people with dementia attending an outpatient geriatric assessment clinic. Ageing Soc. 2020;40(1):205-28. doi: 10.1017/s0144686x18000971.
22. Huang L, Tsai H, Wang Y, Chou C. Sailing in a sea of perplexity: Family caregivers' experience of delirium patients. Nurs Crit Care. 2022 Jan;27(1):73-80. doi: 10.1111/nicc.12620. PMID: 33890387
23. Zhang Y, Yang M, Guo X, Chen Q. Quality of life in family caregivers of adolescents with depression in China: a mixed-method study. Patient Prefer Adherence. 2020 Jul 30;14:1317-27. doi: 10.2147/ppa.s265867. PMID: 32801662; PMCID: PMC7398742.
24. Faul F, Erdfelder E, Lang AG, Buchner A. G*Power 3: A flexible statistical power analysis program for the social, behavioral, and biomedical sciences. Behav Res Methods. 2007 May;39(2):175-91. doi: 10.3758/bf03193146. PMID: 17695343.
25. Doak C, Doak L, Root J, editors. Teaching patients with low literacy skills. 2nd ed. Philadelphia: Lippincott Williams and Wilkins; 1996. pp. 49-59.
26. Jung MH, Park MH, Kim SJ, Ra JR. Delirium-related knowledge, caregiving performance, stress levels, and mental health of family caregivers of terminal cancer patients with delirium in a hospice care unit. J Hosp Palliat Care. 2021 Jun 1;24(2):116-29. doi: 10.14475/jhpc.2021.24.2.116. PMID: 37675238; PMCID: PMC10180047.
27. Toye C, Lester L, Popescu A, McInerney F, Andrews S, Robinson AL. Dementia Knowledge Assessment Tool Version Two: Development of a tool to inform preparation for care planning and delivery in families and care staff. Dementia (London). 2014 Mar 1;13(2):248-56. doi: 10.1177/1471301212471960. PMID: 24339059.
28. Arafat SY, Shams SF, Rahman Chowdhury MH, Chowdhury EZ, Hoque MB, Abdul Bari M. Adaptation and validation of the Bangla Version of the Depression Literacy Questionnaire. J Psychiatry [Internet]. 2017 [cited 2022 Dec 10];20(4):1-4. doi: 10.4172/2378-5756.1000412.
29. Creative Commons. Creative Commons — Attribution-NonCommercial 4.0 International — CC BY-NC 4.0 [Internet]. [cited

2022 Dec 2]. Available from: https://creativecommons.org/licenses/by-nc/4.0/.
30. Creative Commons. Creative Commons — Attribution-NonCommercial-NoDerivatives 4.0 International — CC BY-NC-ND 4.0 [Internet]. [cited 2022 Dec 10]. Available from: https://creativecommons.org/licenses/by-nc-nd/4.0/.
31. MedCalc Software Ltd. MedCalc statistical software [Internet]. 2022 Aug 3 [cited 2022 Nov 24]. Available from: https://www.medcalc.org/.
32. Afify MK. Effect of interactive video length within e-learning environments on cognitive load, cognitive achievement and retention of learning. Turk Online J Distance Educ [Internet]. 2020 Oct 1 [cited 2023 Apr 11];21(4):68-89. doi: 10.17718/tojde.803360.
33. Sablić M, Mirosavljević A, Škugor A. Video-Based Learning (VBL)—past, present and future: An overview of the research published from 2008 to 2019. Tech Know Learn [Internet]. 2021 [cited 2023 Apr 11];26:1061-77. doi: 10.1007/s10758-020-09455-5.
34. Beheshti M, Taspolat A, Kaya OS, Sapanca HF. Characteristics of instructional videos. World J Educ Technol [Internet]. 2018 April 11 [cited 2023 Apr 11];10(2):79-87. doi: 10.18844/wjet.v10i2.3418
35. Albó L, Hernández-Leo D, Moreno Oliver V. Smartphones or laptops in the collaborative classroom? A study of video-based learning in higher education. Behav Inf Technol [Internet]. 2019 [cited 2023 May 6];38(6):637-49. doi: 10.1080/0144929x.2018.1549596.
36. Fang J, Wang Y, Yang CL, Liu C, Wang HC. Understanding the effects of structured note-taking systems for video-based learners in individual and social learning contexts. Proc ACM Hum Comput Interact [Internet]. 2022 Jan 14 [cited 2023 Apr 17];6(GROUP):1-21. doi: 10.1145/3492840.
37. Meyer R, Moreno R, Sweller J. E-Learning Theory [Internet]. 2015 [cited 2022 Oct 3]. Available from: https://learning-theories.com/e-learning-theory-mayer-sweller-moreno.html
38. Costley J, Fanguy M, Lange C, Baldwin M. The effects of video lecture viewing strategies on cognitive load. J Comput High Educ [Internet]. 2021 [cited 2023 Apr 8];33:19-38. doi: 10.1007/s12528-020-09254-y.
39. Paivio A. Dual coding theory: Retrospect and current status. Can J Psychol [Internet]. 1991 [cited 2023 Apr 4];45(3):255-87. doi: 10.1037/h0084295.
40. Harandi SR. Effects of e-learning on students' motivation. Procedia Soc Behav Sci [Internet]. 2015 May 11 [cited 2023 Jun 3];181:423-30. doi: 10.1016/j.sbspro.2015.04.905.
41. Al-Qatawneh S, Alsalhi N, Al Rawashdeh A, Ismail T, Aljarrah K. To E-textbook or not to E-textbook? A quantitative analysis of the extent of the use of E-textbooks at Ajman University from students' perspectives. Educ Inf Technol [Internet]. 2019 Apr 16 [cited 2023 Apr 10];24:2997-3019. doi: 10.1007/s10639-019-09912-4.
42. Swanson E, Austin CR, Stewart AA, Scammacca N. A meta-analysis examining the effect of e-book use on literacy outcomes for students in Grades K–12. Read Writ Q [Internet]. 2020 Jan 21 [cited 2023 Apr 10];36(5):480-96. doi: 10.1080/10573569.2019.1696724.
43. Blummer B, Kenton JM. A systematic review of e-books in academic libraries: access, advantages, and usage. New Rev Acad Librariansh [Internet]. 2020 [cited 2023 Apr 10];26(1):79-109. doi: 10.1080/13614533.2018.1524390.
44. Rahim FR, Suherman DS, Muttaqiin A. Exploring the effectiveness of e-book for students on learning material: a literature review. J Phys [Internet]. 2020 Mar [cited 2023 Jun 3];1481:012105. doi: 10.1088/1742-6596/1481/1/012105.
45. Zhang X, Tlili A, Shubeck K, Hu X, Huang R, Zhu L. Teachers' adoption of an open and interactive e-book for teaching K-12 students Artificial Intelligence: a mixed methods inquiry. Smart Learn Environ [Internet]. 2021 Dec 11 [cited 2023 Apr 11];8(34):1-20. doi: 10.1186/s40561-021-00176-5.
46. Konstantellou E, Lose MK. The promise of Clay's Theory of Literacy Processing: Training literacy lessons intervention specialists. J Read Recovery [Internet]. 2009 [cited 2023 Apr 12];9(1):62-9. Available from: https://oakland.edu/Assets/Oakland/readingrecovery/files-and-documents/JRR_9.1_Konstantellou_Lose.pdf
47. Ryan RM, Deci EL. Self-determination theory and the facilitation of intrinsic motivation, social development, and well-being. Am Psychol. 2000 Jan];55(1):58-78. doi: 10.1037//0003-066x.55.1.68. PMID: 11392867.
48. Palumbo R, Di Domenico A, Fairfield B, Mammarella N. When twice is better than once: increased liking of repeated items influences memory in younger and older adults. BMC Psychol. 2021 Feb 6;9(1):25. doi: 10.1186/s40359-021-00531-8. PMID: 33549132; PMCID: PMC7866445.
49. Karpicke JD, Roediger HL 3rd. The critical importance of retrieval for learning. Science. 2008 Feb 15;319(5865):966-8. doi: 10.1126/science.1152408. PMID: 18276894.
50. Pyc MA, Rawson KA. Testing the retrieval effort hypothesis: Does greater difficulty correctly recalling information lead to higher levels of memory? J Mem Lang. 2009 May;60(4):437-47. doi: 10.1016/j.jml.2009.01.004.