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The effect of a video-guided educational technology intervention on the academic self-concept of adolescent students with hearing impairment

Implications for physical education

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Abstract

Background/Objective: Academic self-concept is an important construct within the disciplines of medicine, psychology, and education. Enhancing the academic self-concept of students with special educational needs is very crucial because it is associated with their quality of life. This study aimed to examine the effect of a video-guided educational technology intervention on the academic self-concept of adolescents with hearing impairment who were attending inclusive nonresidential public schools in Southeast Nigeria.

Methods: This study adopted a randomized controlled trial design. The participants were 60 junior secondary students with hearing impairment. We implemented a video-guided educational technology intervention. It relied on the use of 13-minute video clips with captions/subtitles, which covered academic self-concept-related themes. The Academic Self-Concept Questionnaire, which has been developed by Liu and Wang, was used to collect baseline, posttreatment, and follow-up data. We conducted independent-samples and paired t test and computed Cohen d and Glass Δ to analyze the data.

Results: The video-guided educational technology intervention significantly improved the academic self-concept of the treatment group participants, when compared with the care-as-usual control group participants, $t(58) = 9.07$, $P < .001$. These improvements in academic self-concept were sustained at follow up among the treatment group participants, when compared with the care-as-usual control group participants, $t(48.56) = 10.898$, $P < .001$. Within-subjects comparisons showed that the academic self-concept of the treatment group participants had significantly improved across the different time points at which they were assessed.

Conclusion: The video-guided educational technology intervention was effective in improving the academic self-concept of adolescents with hearing impairment who were attending inclusive nonresidential public schools. Large-scale studies are needed to maximize the impact of video-guided educational technology interventions on students with hearing impairments who attend inclusive non residential public schools in Nigeria.

Abbreviation: ASCQ = Academic Self-Concept Questionnaire.

Keywords: academic self-concept, adolescent school students, hearing impairment, physical education, video-guided educational technology intervention

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The authors have no conflicts of interest to disclose.

The datasets generated during and/or analyzed during the current study are available from the corresponding author on reasonable request.

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1. Introduction

Enhancing the academic self-concept of students with special educational needs is very crucial because it is associated with their quality of life.[1] Academic self-concept is a domain of the composite construct of self-concept, and it refers to a student's perceived ability to succeed in a specific academic domain (e.g., physical education). It is shaped by academically oriented interactions with fellow students, teachers, and parents.[2–4] Some scholars have defined academic self-concept as student perceptions of their capabilities, which develop within specific academic domains and through academic interactions.[5] Past studies have found that students with favorable academic self-concepts tend to reportedly participate more in small group discussions than their counterparts with poor academic self-concepts.[3] Further, students with hearing impairment (i.e., deaf and hard-of-hearing students), whose parents are also hearing impaired, tend to have a better self-concept than their counterparts with hearing parents.[6]

Past studies have found that students with hearing impairment who attend boarding schools have a better self-concept than those who attend nonresidential public schools.[6] Students with hearing impairment have a poorer self-concept than hearing students because they are more likely to experience school failure, information processing problems, and segregation in regular schools.[7] Past studies have found that there is no significant difference in the academic self-concepts of male and female students who are visually impaired.[7] Thus, we theorized that a video-guided educational technology intervention will be effective in improving the academic self-concept of male and female adolescents with hearing impairment who attend nonresidential public schools.

Video-guided educational technology interventions are a type of educational intervention in which participants are divided into small groups and guided to reflect upon and evaluate the contents of video clips with subtitles/captions to address the main concerns that motivated them to join the group. Video-guided educational technology interventions are founded upon the tenets of Bandura[8] social learning theory, which posits that individuals learn to achieve desirable outcomes either through direct experience or by observing the behaviors of others. In a past study, a video-guided group intervention improved the center of balance (i.e., a risk factor for falling) of community-dwelling older adults.[9] In another study, a video-guided intervention resulted in considerable improvements in the knee flexion range of motion and pressure pain thresholds.[10] In yet another study, the researchers aimed to develop a video-guided program to improve advanced cardiopulmonary resuscitation decision-making. Accordingly, they conducted a qualitative study and finalized the structure of the program based on the emergent themes.[11]

In an earlier study, a video-guided approach was adopted to help fourth-year medical students acquire procedural skills during an ultrasound-guided central line training program.[12] Using a quasi-experimental design, Omoniyi and Oluniyi[13] found that captioned video instructions were effective in significantly improving English language performance among pupils with hearing impairment who attended special primary schools. Fakomogbon[14] found that video-guided instructions, which were delivered through video clips with captions, were significantly beneficial to students with hearing impairment during a metalwork class. Because of their effectiveness as instructional tools, captions should be included in media materials that are designed for individuals with hearing impairment.[15] However, there is a paucity of empirical evidence regarding the therapeutic effects of video-guided interventions on the academic self-concepts of adolescents with hearing impairment who attend inclusive nonresidential public schools. Thus, the objective of this study was to examine the effects of a video-guided educational technology intervention on the academic self-concept of adolescents with hearing impairment who attend inclusive nonresidential public schools in Southeast Nigeria.

1.1. Hypothesis

The video-guided educational technology intervention will significantly enhance the academic self-concept of adolescents with hearing impairment who attend inclusive nonresidential public schools.

2. Methods

2.1. Ethical considerations

The Faculty of Education Research Ethics Committee of the University of Nigeria, Nsukka, approved this study (protocol number: REC/FE/2018/000067). We conducted this study in accordance with the ethical principles outlined in the WMA Declaration of Helsinki. We informed the participants that participation in this study was voluntary and that they could withdraw their participation at any time.

2.2. Study design

This study was a randomized controlled trial.

2.3. Study setting

This study was conducted in Southeast Nigeria, which comprises 5 states, namely, Abia, Anambra, Enugu, Ebonyi, and Imo. Igbo-speaking ethnic groups and residents from other parts of the country live in these 5 states. The 5 states cover the country's vast geographical area, which extends from 4°15′ to 7°5′N and from 5°32′ to 9′E. In the west, the zone shares its borders with the Delta State, and, in the east, it shares its borders with the Cross River. In the north, it shares its borders with Kogi and Benue State. Its area is approximately 40,000 km^2 (16,000 mi^2), and its density is 400/km^2 (1000/mi^2).[16]

2.4. Participants

The participants were junior secondary students with hearing impairment. They were attending inclusive nonresidential public schools in Southeast Nigeria. A total of 300 students with hearing impairment were screened for eligibility. The first 60 students with hearing impairment who met the inclusion criteria constituted the sample. We decided to include only the first 60 participants who were eligible because this investigation was a self-funded study. Using G*Power and the following specifications, we estimated the required sample size: statistical power = 0.83, Cohen $d = 0.80$, $\alpha = 0.05$, and 2-tailed t test (Fig. 1).[17] The required sample size was 56, and the size of our sample exceeded this figure. To prevent selection bias, a random allocation sequence was generated using Random Allocation Software.[18] This method of random allocation sequence generation yielded computer-generated random numbers, which were used to assign the participants to either the treatment (n = 30) or care-as-usual control group (n = 30). In accordance with Dettori recommendations,[19] the sequence was

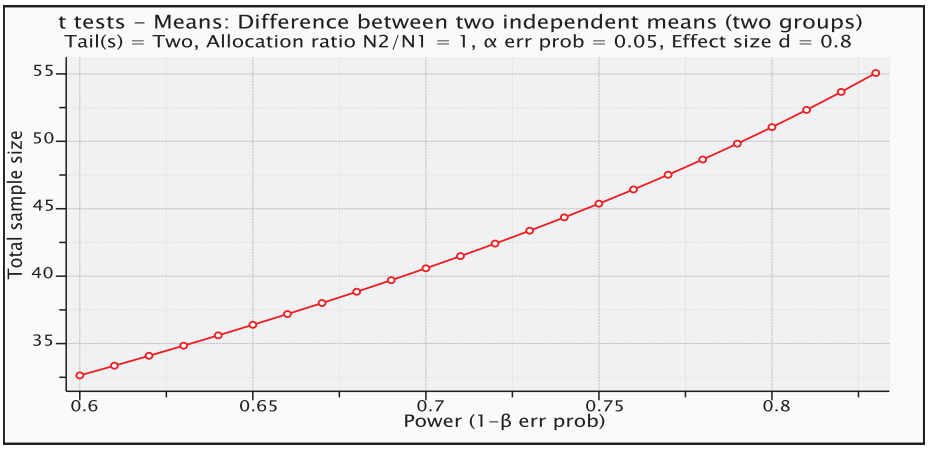

Figure 1. Sample size calculation through Gpower software.

implemented using sequentially numbered, opaque, sealed envelopes, and pressure sensitive paper to conceal allocations until the participants were assigned to the 2 groups. Figure 2 presents the study flowchart, which depicts the inclusion and exclusion of participants based on their eligibility (see Fig. 2). Table 1 presents the sample characteristics.

2.5. Eligibility criteria

During recruitment, a student was included if he/she met the following criteria: has been clinically confirmed to be deaf or hard of hearing, has hearing parents, has reported/demonstrated a poor academic self-concept, has completed and submitted the informed assent form, and his/her parents/guardians have completed and returned the informed consent form to permit him/her to participate in the study. A potential participant was considered to be ineligible if he/she met the following criteria: has no medical record certifying that he/she is deaf or hard of hearing, has a deaf parent, showed evidence of high academic self-concept, cannot provide informed assent, or his/her parents/guardian did not complete and return the informed consent form to permit him/her to participate in the study.

2.6. Intervention procedure and treatment package

This study was conducted between February and August 2019. First, written permission was obtained from the participating schools. Subsequently, the parents/guardians of potential participants completed and returned informed consent forms to permit their wards to participate in the study. Next, students whose parents/guardians completed and returned informed consent forms completed an informed assent form and the Academic Self-Concept Questionnaire (ASCQ)[20] at baseline. Two weeks after baseline, the 3-month intervention commenced (i.e., approximately 12 weeks). We conducted 1 treatment session per week, and this amounted to a total of 12 treatment sessions. Immediately after the last treatment session ended, we distributed the ASCQ to collect posttreatment data from the participants. Three months after the intervention, 4 follow-up sessions were conducted across a period of 1 month. Immediately after the last follow-up session ended, we distributed the ASCQ to collect follow-up data from the participants. Two of the authors who are specialists in sign language coordinated the delivery of the present intervention.

We developed and implemented a video-guided educational technology intervention to improve the academic self-concept of the treatment group participants. The video-guided educational technology intervention relied on the use of 13-minute video clips with English captions/subtitles, which covered different themes related to academic self-concept. Each video clip addresses academic self-concept-related themes by depicting a group of individuals with hearing impairment. The themes were as follows: understanding self-concept, the different types of self-concepts, the importance of academic self-concept, the relationship between academic self-concept and hearing impairment, understanding the self within the context of one's relationships with peers, teachers, and parents, the relationship between academic self-concept and school achievement, the adverse effects of a negative academic self-concept, the formation of a positive academic self-concept, strategies that enhance and maintain a positive academic self-concept, and the relationship between academic self-concept and life after graduation. After they viewed a video clip, the participants reflected upon and shared their experiences and feelings, asked questions, and received feedback through sign language. This discussion lasted for 30 minutes per session. A sign language specialist anchored each discussion session.

With regard to the care-as-usual intervention that was provided to the control group, the traditional advisory model of help, which does not consider the disability that a student has, was adopted. All the control group participants attended 1 group session per week across a period of 3 months (i.e., approximately 12 weeks). A sign language specialist anchored each discussion session that focused on academic self-concept. The group session relied exclusively on sign language interactions in English, and each session lasted for 13 minutes. At the end of each session, we set aside 30 minutes so that the participants could reflect upon and share their experiences and feelings, ask questions, and receive feedback through sign language.

To motivate the students to continue participating in the study, they were provided with transportation and refreshments at the end of each session. Further, reminders about the session were sent to the mobile phones of their parents/guardians.

2.7. Outcome measure

Data were collected using a self-report measure of academic self-concept, namely, the ASCQ, which has been developed by Liu

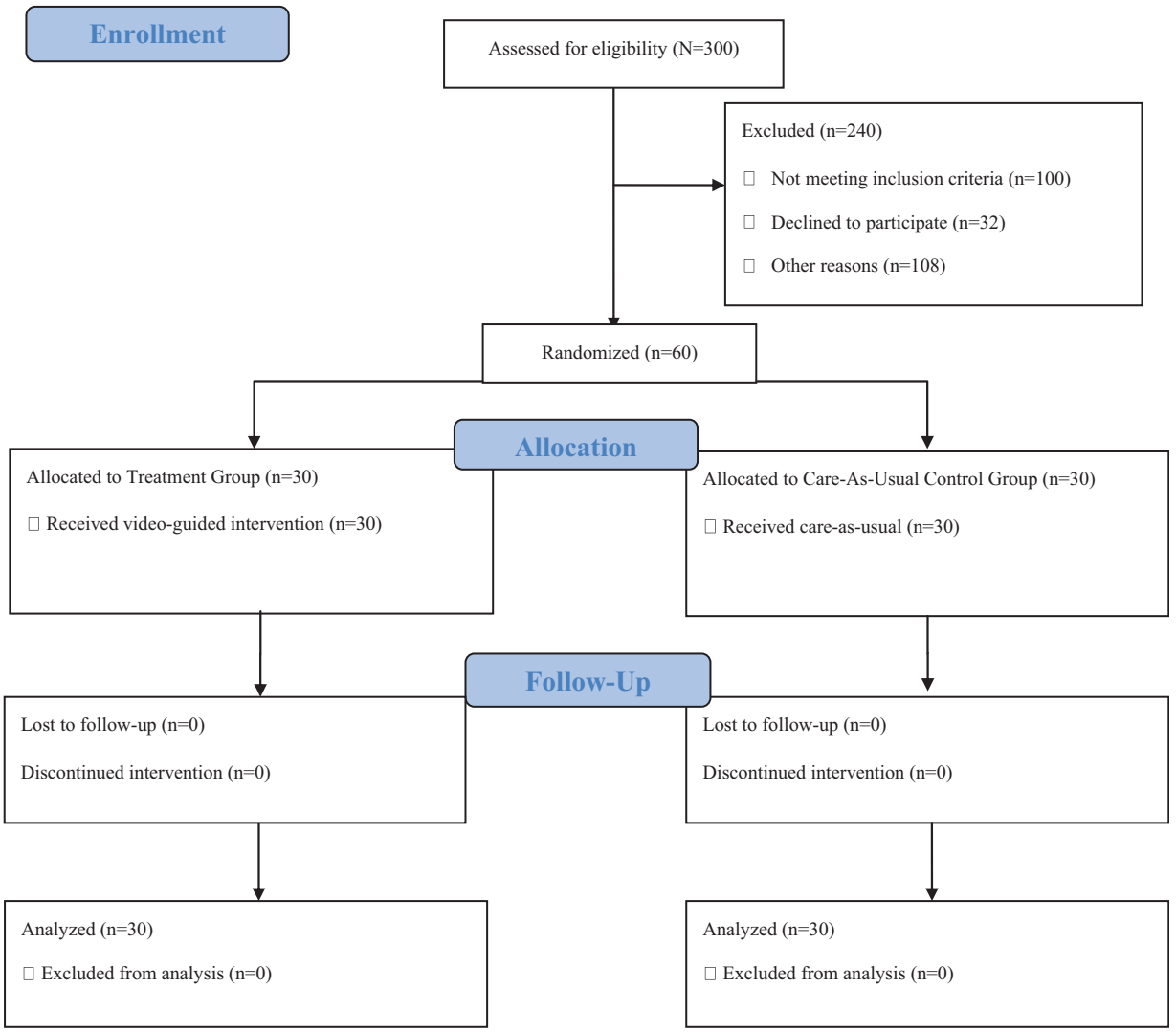

Figure 2. CONSORT flowchart for participant eligibility criteria.

and Wang.[20] This assessment was used to collect baseline, posttreatment, and follow-up data. The ASCQ is a 20-item self-report measure of student conceptions of their academic confidence and effort. The items are rated on a 4-point scale, which ranges from strongly agree to strongly disagree. Higher scores are indicative of a positive academic self-concept. The ASCQ is a valid and reliable measure of the academic self-concept of adolescent school students (Cronbach $\alpha = 0.65–0.89$).[20–23] The ASCQ has also been validated among students with learning disabilities.[24] In this study, the Cronbach α of this scale was

Table 1

Demographic characteristics of participants.

Characteristics	Levels	Treatment	Control	*t* test	Significance	Phi and Cramer *V*
Age		12.93 ± 1.60	12.33 ± 1.56	1.472	0.146	
		n (%)	n (%)	χ^2	Significance	
Gender	Male	15 (51.7)	14 (48.3)	0.067	0.796	0.033
	Female	15 (48.4)	16 (51.6)			
Age range	10–12 yrs	11 (35.5)	20 (64.5)	5.406	0.020	0.300
	13–15 yrs	19 (65.5)	10 (34.5)			
School type	Boys only school	7 (43.8)	9 (56.2)	0.351	0.839	0.077
	Girls only school	8 (53.3)	7 (46.7)			
	Mixed school	15 (51.7)	14 (48.3)			
Hearing impairment	Deaf	19 (51.4)	18 (48.6)	0.071	0.791	0.034
	Hard-of-hearing	11 (47.8)	12 (52.2)			

0.91. Additionally, a demographic questionnaire was used to assess participant characteristics such as age, date of birth, sex, and the type of hearing impairment.

2.8. Data analysis

The collected data were processed and analyzed using SPSS version 20 (IBM, SPSS Inc., Chicago, Ill., USA). Some sections of the questionnaire were blurred (i.e., a blinding strategy) to minimize bias on the part of the data analysts. We examined the continuous variables by computing means and standard deviations, and we examined the categorical variables by computing frequencies and percentages. Chi-squared analysis was conducted to examine the significance of differences in categorical variables. To examine the significance of mean differences between the treatment and care-as-usual control groups, independent-samples *t* test was conducted. Further, paired *t* test was conducted to examine the significance of the difference between the means of each group at different time points. The level of significance was set as $P \leq .05$. We ascertained the treatment effect size by computing Cohen d[25] and Glass Δ.[26] Prior to data analysis, we tested the assumption of the homogeneity of variances by conducting Levene test of the equality of variances. Moreover, the Shapiro-Wilk test of normality showed that our data were normally distributed.

3. Results

The average age of the participants was 12 years. Further, 10 to 12-year-old (n = 31) and 13 to 15-year-old students (n = 29) were represented approximately equally. The sex distribution of the 2 groups was fairly similar, $\chi^2(2) = 0.067$, $P = .80$. Most of the participants attended mixed schools (n = 29, 48.3%) and were deaf (n = 37, 61.7%). Very low Phi and Cramer *V* values emerged for all participant characteristics, except age. This indicated that there was a very weak relationship between the different levels of the variables (Table 1).

Table 2 shows that the mean academic self-concept scores of the intervention group at Time 1 (i.e., before the intervention) and Time 2 (i.e., after the intervention) (Time 1 = 24.10 ± 3.71, Time 2 = 36.50 ± 5.62) were markedly different. In contrast, the difference in the mean academic self-concept scores of the care-as-usual control group participants at Time 1 and Time 2 was negligible (Time 1 = 24.07 ± 4.53, Time 2 = 24.47 ± 4.61). Further, when compared across different time points, especially between Time 2 (i.e., after the intervention) and Time 3 (i.e., at follow up), the treatment group participants appeared to have obtained higher mean academic self-concept scores than the care-as-usual control group participants.

Table 2

Summary of descriptive statistics.

Group		Time 1	Time 2	Time 3
Treatment	Mean	24.10	36.50	36.90
	N	30	30	30
	Std. Deviation	3.71	5.62	5.02
Care-as-usual	Mean	24.07	24.47	25.13
	N	30	30	30
	Std. Deviation	4.53	4.61	3.13
Total	Mean	24.08	30.48	31.02
	N	60	60	60
	Std. Deviation	4.10	7.92	7.24

With regard to group differences in posttreatment scores, between-subjects analysis (Table 3) showed that there was a significant group difference in mean academic self-concept scores (Time 2: $t(58) = 9.071$, $P < .001$; Time 3: $t(48.56) = 10.898$, $P < .001$). Thus, at Time 2 and Time 3, the treatment group participants had a significantly more positive academic self-concept than the care-as-usual control group participants did. This finding underscores the effectiveness of the video-guided educational technology intervention in improving the academic self-concept of adolescents with hearing impairment who were attending inclusive nonresidential public schools in Southeast Nigeria.

The results of within-subjects analysis (Table 4) showed that the mean academic self-concept scores of the treatment group participants had significantly changed between Time 1 and Time 2, $t(29) = -10.904$, $P < .001$, but not between Time 2 and Time 3, $t(29) = -0.691$, $P = .50$. This suggests that the video-guided educational technology intervention was effective and that these effects were sustained at follow up. Moreover, the effect size that emerged for the treatment group further underscores the effectiveness of this intervention. With regard to the care-as-usual group participants, their mean academic self-concept scores did not significantly change across time.

4. Discussion

The present study examined the effect of a video-guided educational technology intervention on the academic self-concept of adolescents with hearing impairment who attended inclusive nonresidential public schools in Southeast Nigeria. The video-guided educational technology intervention significantly improved the academic self-concept of the treatment group participants, when compared with the care-as-usual control group participants. These improvements in academic self-concept were sustained at follow up among the treatment group

Table 3

Between-group comparison independent sample *t* test for treatment and care-as-usual group at time 1 and time 2.

Time	Group	Mean	*t*	*df*	*P*	Effect size
Time 1	Treatment	24.10 ± 3.71	0.031	58	.975	. . . ..
	Care-as-usual	24.07 ± 4.53				
Time 2	Treatment	36.50 ± 5.62	9.071	58	<.001	2.141*
	Care-as-usual	24.47 ± 4.61				
Time 3	Treatment	36.90 ± 5.02	10.898	48.56	<.001	2.345*
	Care-as-usual	25.13 ± 3.13				

* Glass's delta (Δ) because standard deviations are not similar.

Table 4

Within-group comparison paired sample *t* test for treatment and care-as-usual groups at time 1 and time 2.

Group	Time	Mean	*t*	*df*	*P*	Effect size
Treatment	Time 1	24.10 ± 3.71	−10.904	29	<.001	3.342*
	Time 2	36.50 ± 5.62				
Care-as-usual	Time 1	24.07 ± 4.53	1.439	29	.161	0.087†
	Time 2	24.47 ± 4.61				
Treatment	Time 2	36.50 ± 5.62	−0.691	29	.495	0.071†
	Time 3	36.90 ± 5.02				
Care-as-usual	Time 2	24.47 ± 4.61	1.157	29	.257	0.143*
	Time 3	25.13 ± 3.13				

* Glass's delta (Δ) because standard deviations are not similar.
† Cohen *d* because the standard deviations appear similar.

participants, when compared with the care-as-usual control group participants. Within-subjects comparisons showed that the academic self-concept of the treatment group participants significantly improved between Time 1 and Time 2. These results are consistent with past findings, which suggest that video-guided interventions are beneficial to students. For instance, Omoniyi and Oluniyi[13] found that captioned video instructions significantly improve performance among pupils with hearing impairment. Similarly, Fakomogbon[14] found that video-guided instructions are significantly beneficial to students with hearing impairment. A meta-analytic study conducted by Balldin et al[27] showed that video feedback interventions have moderate to large effects on intervention group participants. In Stinson and Stevenson[28] study, instructional videos with captions improved the extent to which deaf college students comprehended educational videos. Specifically, their posttest performance was better than their pretest performance. James et al[29] found that video-guided interventions are effective in promoting prelinguistic development in children with hearing impairment. Thus, in accordance with the present findings, medical educators should use video-guided interventions to impart the requisite skills to students with hearing impairment who require medical and psychological care. Further, policymakers and researchers should work collaboratively to ensure that such students benefit from the educational interventions and training programs that are designed to improve their psychological health and wellbeing, irrespective of their disability.

The present findings have implications for large-scale research and physical education. In a study conducted among Nigerian students, the prevalence of hearing loss was13.9%.[30] Therefore, large-scale studies are needed to maximize the impact of video-guided educational technology interventions on students with hearing impairment in Nigerian schools. Students with different disabilities have different special educational needs in physical education classes.[31,32] Therefore, students should be provided with video-guided interventions that are accommodative of their unique needs. Within the domain of physical education, experts have noted that students with hearing impairment are the easiest group to work with, when compared with students with other types of disabilities.[32,33] Physical education is a very important academic subject because it affords educators an opportunity to improve the motor skills, cognitive and decision-making abilities, and health behaviors of students.[34–36] Physical education can foster school inclusion among students with hearing impairment.[32,34] Schools serve as an important space within which physical education activities that aim to improve health and wellbeing can be promoted.[37,38] During physical education classes, most adolescents are afforded the opportunity to acquire the knowledge, skills, and behaviors that they need to lead a vigorous and healthy life.[36] Thus, providing video-guided educational technology interventions to students with hearing impairment who are enrolled in physical education courses in Nigerian schools will improve their ability to grasp course contents.

4.1. Limitations and strengths

The present findings should be interpreted within the confines of the limitations of this study. The students with hearing impairment, who participated in this study, were recruited from inclusive nonresidential public schools. Therefore, the sample may not have been representative of students who attend special nonresidential public schools, inclusive residential public schools, and private schools. Moreover, we did not use qualitative measures of academic self-concept in this study. This can limit the applicability of the present findings, when the lived experiences of students are considered. Future studies should consider investigating this issue among students with hearing impairments in school settings that were not examined in this study. Further, future studies should adopt a mixed-methods approach and collect both qualitative and quantitative data from participants.

Despite the aforementioned limitations, this study has a few strengths. First, both between-subjects and within-subjects analyses were undertaken. Between-subjects analysis minimizes the effects of extraneous factors, whereas within-subjects analysis facilitates the detection of true significance because it entails lesser variability and minimizes random noise. Moreover, a self-administered questionnaire was used, and this is likely to have reduced the risk of bias. Furthermore, the intervention components were well articulated. The present findings bridge the gaps in the existing literature on the therapeutic effects of video-guided educational technology interventions on adolescents with hearing impairment who attend inclusive nonresidential public schools in Nigeria.

5. Conclusion

The present findings extend the existing knowledge on the therapeutic effects of video-guided interventions on students. In this study, the video-guided educational technology intervention was effective in improving the academic self-concept of adolescents with hearing impairment who were attending

inclusive nonresidential public schools. When compared with the care-as-usual control intervention, the video-guided educational technology intervention resulted in temporally sustained (i.e., at follow-up) improvements in academic self-concept. Large-scale studies are needed to maximize the impact of video-guided educational technology interventions on students with hearing impairment who attend inclusive nonresidential public schools in Nigeria. Our findings are likely to promote further interdisciplinary collaborations among educational technologists, counseling and educational psychologists, special and physical education specialists, and clinical trialists in relation to the design, validation, and implementation of video-guided educational technology interventions for those with special needs.

Author contributions

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