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체육학석사 학위논문

Evaluating online knowledge
translation of adapted physical
activity for people with
developmental disabilities

발달장애인을 위한 특수체육의
온라인 지식전환 평가

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서울대학교 대학원

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Evaluating online knowledge
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이 논문을 체육학석사 학위논문으로 제출함
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Abstract

Knowledge translation (KT) is an iterative process that translates research findings into practical information for users. Despite active knowledge production in adapted physical activity (APA), this knowledge is not delivered to people with developmental disabilities, causing a knowledge-to-action gap. This study aims to use a realistic evaluation (RE) of the online KT of APA in Korea to diagnose the gap. Fifteen pairs of a person with developmental disabilities and a primary caregiver participated in the study. Three websites were selected for evaluation using the web usability test, content quality evaluation rubric, and in-depth interviews. This study demonstrates context, enabling and constraining mechanisms, and the outcomes of web usability and content quality. The RE was conducted within the KT framework to define facilitators and barriers in the online KT of APA in Korea. The results of this study may contribute to the improvement of the online KT of APA.

Keywords : realistic evaluation, usability, content quality, accessibility

Student Number : 2021-27329

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Chapter 1. Introduction

1.1. Background

People with developmental disabilities remain socially and physically inactive because of a number of environmental barriers to information access (Draheim et al., 2002). People with developmental disabilities are not provided with equal types or amounts of health-related content or opportunities compared to people without disabilities (Siberski et al., 2015). Furthermore, barriers to accessing and utilizing information due to poor communication skills of people with developmental disabilities related to computers, mobile devices, and the Internet cause social isolation (Moisey, 2007). Moreover, people with developmental disabilities have poor knowledge of and limited access to physical activity (PA) information, which prevents them from participating in physical activity (Jaarsma, 2019; Rimmer et al., 2004; Smith & Sparkes, 2012).

Knowledge translation (KT) is a conceptual framework that intends to help the target population by delivering sustainable, evidence-based practice based on academic findings (Graham, 2006). It is defined as “a dynamic and iterative process that includes the synthesis, dissemination, exchange and ethically sound application of knowledge to improve health status, provide more effective health services and products, and strengthen the healthcare system” (Canadian Institutes of Health Research, 2012).

Simply put, it means translating professional knowledge into practical information delivered in a format appropriate for those who can make the best use of it (Straus et al., 2013). KT entails a range of strategies from a limited stakeholder audience, such as in-service training and communities of practice, to a broader audience, such as mass media, websites, and blogs. KT also involves the emotional and cognitive domains of the audience (Barwick et al., 2008; Barwick et al., 2009; Boydell et al., 2012); thus, it is regarded as the best practice to ensure the inclusion of end users (e.g., people with disabilities and supporters) throughout the research process (Kothari & Wathen, 2013). KT views knowledge as a two-way exchange between knowledge producers and knowledge users; users are assumed to be subject matter experts (Davies et al., 2008).

Demonstrating the knowledge-to-action gap is the first step in implementing knowledge in the target population (Straus et al., 2013). The knowledge-to-action gap refers to the gap between literature knowledge and actual practice (Kitson & Straus, 2010). Several studies have explored the KT process from information distributors to people with physical disabilities (Faulkner et al., 2010; Letts et al., 2011; Smith et al., 2015) to determine barriers to participation in PA and seek appropriate delivery methods to narrow the knowledge-to-action gap. Moreover, the KT framework has been implemented to promote health-related fields for people with developmental disabilities (Anaby et al., 2015; Spassiani et al., 2015; Shooshtari et al.,

2014; Ouellette-Kuntz et al., 2010).

Despite active knowledge production in the field of adapted physical activity (APA), professional knowledge and information are not delivered in the form of practical information to knowledge users (Ginis et al., 2010). Moreover, Jung et al. (2018) stated that people with developmental disabilities in Korea have difficulty accessing information on leisure, including PA and sports, due to their incompetence in using websites on mobile devices and need more accessible forms of information to participate in diverse leisure activities. This finding suggests that online APA-related information is not adequately provided to reach the target audience.

The KT framework proposed by Lavis et al. (2003) has been employed in previous studies to determine effective ways of communicating information to people with various disabilities (Grimshaw et al., 2012; Boyko et al., 2012; Nguyen et al., 2020). The framework consists of a PA content audience, which refers to the importance of tailoring messages appropriately for the target audience; PA content messengers, which refer to the participants' perceived importance of messengers; PA content methods, which demonstrate the appropriateness of the delivery format; and PA content improvement, which refers to the feedback communication between knowledge creators and users (Table 1). Jaarsma (2019) utilized the KT

framework to explore the accessibility of PA information to people with disabilities. A previous study demonstrated that disseminating PA information is much more effective for people with disabilities when senders include the practical importance of PA for disabilities, including credible messengers, understanding the mechanism of motivation to participate in PA, using multiple delivery methods (Jaarsma, 2019).

Table 1. KT framework (Lavis et al., 2003)

PA content audience	The importance of understanding the target audience within the content network and how messages should be tailored to suit the audience
PA content messengers	The participants' views on the importance of the role of "messengers" within the communication network that
PA content methods	The participants' understanding the format of how to deliver APA contents to the targeted audience
PA content improvement	The participants' suggestions to improve the communication flow of APA content

Several studies utilized the KT framework to explore and evaluate health-related fields, including PA. To date, however, most investigations and evaluations of KT for people with developmental disabilities have been conducted by stakeholders such as practitioners and educators. Consequently, the results were limited to theoretical suggestions for improving the translation process. Furthermore, the context of how people with developmental disabilities and caregivers use Internet search engines and mobile applications as the primary sources of health-related knowledge

(Bussing et al., 2012; Fox & Duggan, 2012; 2013) highlights the need to evaluate the quality of online health-related communication between stakeholders and knowledge users.

1.2. Objective

Since little is known about knowledge delivery to people with developmental disabilities via online platforms, it is essential to explore and evaluate the online KT of APA to demonstrate barriers and facilitators in communication between knowledge producers and end users (e.g., people with developmental disabilities and caregivers). Therefore, this study aimed to evaluate the KT process of online APA information to demonstrate the knowledge-to-action gap among people with developmental disabilities in Korea. The evaluation of KT consists of web usability, content quality evaluation, and in-depth exploration of barriers to and facilitators of KT. The evaluation results provide a thorough analysis of the online KT of APA in Korea. Moreover, exploring the possibility of improving access to and the quality of online APA information could help provide suggestions for encouraging APA practices for people with developmental disabilities.

1.3. Literature Review

Online KT of PA

The concept of KT has been widely used to evaluate the effectiveness of health interventions). The knowledge-to-action cycle is one of the frameworks to guide the practice of KT online and offline for knowledge creators. The cycle embraces stages of identifying problems; determining the knowledge-to-practice gap; adapting knowledge to local context; assessing barriers and facilitators to knowledge use; tailoring and implementing interventions; monitoring knowledge use; and evaluating outcomes (Graham et al., 2006). In addition, the KT emphasizes two-way interactions between knowledge creators and users. In that sense, the KT-based interventions are proven practical to allow interaction between knowledge creators and users (Bérubé et al., 2018).

As the internet is increasingly used for delivering KT benefits, including cost and time effectiveness (Mairs et al., 2013), the interest in the accessibility and usability of web-based platforms is increased. Web-based KT embraces accessibility, reaching a large audience, ease of use, and promotion of self-directed and self-paced learning for target users (Mathur et al., 2005; Cheng & Martin, 2011; Levac et al., 2015). Past scholarship utilized social media and interpersonal contacts to expand health information delivery (Green et al., 2009). One study demonstrated that the

advantage of using social media was the possibility of sharing information, which leads to user acquisition and retention. Plus, the information provider could track user engagement on specific domains, contributing to creating more user-centered information (Puljak, 2016).

Previous research using online guidelines to deliver interventions faced challenges with technology access, digital literacy, as well as capability of creating ‘appropriate’ content for the practitioners (Levac et al., 2015; Menon et al., 2012; Graham et al., 2006; Gaunt et al., 2010). Moreover, review works by Curran and Fleet (2005), Daraz et al. (2019), and Mącznik et al. (2021) demonstrated that the quality of web platforms might hinder delivering evidence-based health information online. Despite the spiking increase in internet use, the content quality does not meet the standards. Some web-based information was outdated, leading to a lessening the trustworthiness of the platforms. (Iftikhar & Abaalkhail, 2017). The trustworthiness and readability of web platforms are essential in delivering information and retaining users. The platforms with more accessible language are perceived as more ‘trustworthy’ regardless of the actual credibility of the information. In addition, images are encouraged to facilitate the users’ understanding. The information created with community involvement had higher quality, while the lower readability acted as a barrier to user acquisition (Scharer et al., 2019).

Jaarsma et al. (2019) highlighted facilitators and barriers in knowledge translation of physical activity for people with physical disabilities. The study results show that social media is the primary source of accessing physical activity-related information. However, the limitation of social media was also demonstrated that only limited users are exposed to the physical activity information, raising the importance of organizational strategy to increase user accessibility to the information. Tristani et al. (2017) work on evaluating web-based information for children with disabilities with the content-analysis approach to theory-specified persuasive educational communication. The study concluded that web-based platforms are recommended initiatives to promote physical activity for children with disabilities. It also proposed the need for further research in tailoring websites to improve user engagement and content quality targeted at people with disabilities (Tristani et al., 2017).

Chapter 2. Methods

This study employs a qualitative design by using descriptive statistics from surveys, analysis with an evaluation rubric, and analysis of interviews. This study invites people with developmental disabilities and their primary caregivers as critical informants who demonstrate the knowledge-to-action gap and co-designers for better information design for knowledge users. Researchers have chosen the realist point of view in evaluating the KT of online APA. Ethical considerations were reviewed and approved by the Institutional Ethics Review Board of the university.

2.1. Realistic Evaluation of Knowledge Translation

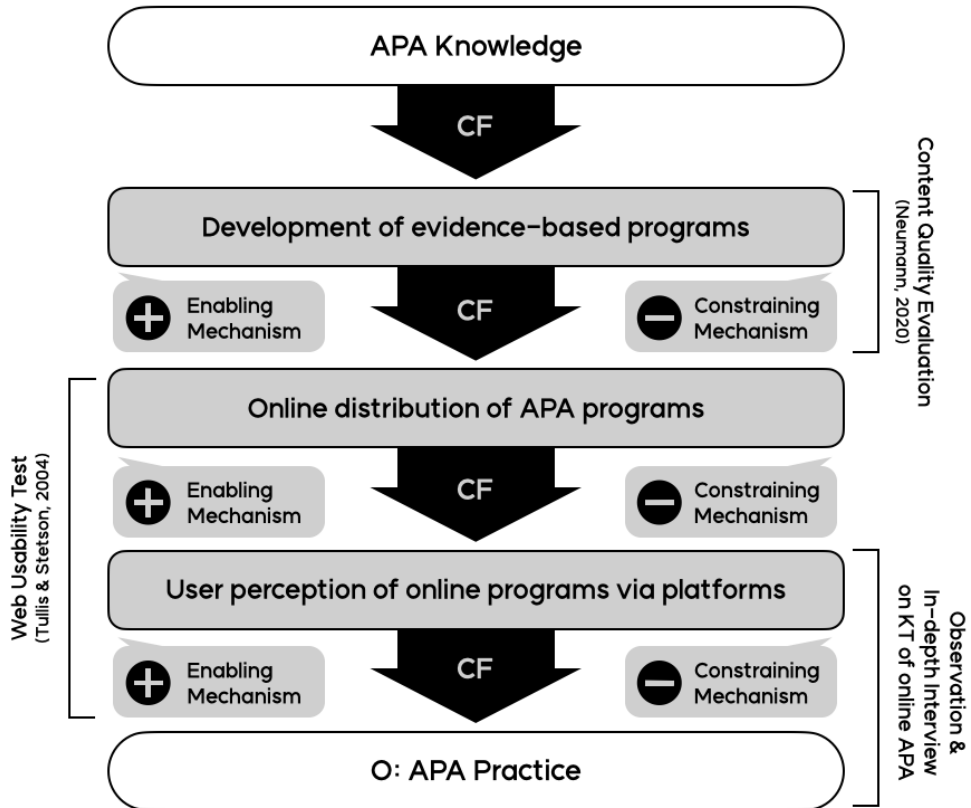
To explore the communication of online APA knowledge for people with developmental disabilities, a realistic evaluation (RE) of KT is used to describe the facilitators of and barriers to online APA practice. RE is a theory-driven approach that evaluates how expected changes occur to evaluate “what works for whom, in what circumstances, and in what respect and how” (Pawson & Tilley 1997, 2004). RE is based on the understanding that every intervention reflects a “program theory,” a posited causal chain from activities to outcomes via the mechanism. Program theory focuses on mechanisms rather than intervention activities, allowing diverse practices according to the same logic of action (Weiss, 1997). RE examines outcomes as a joint product of mechanisms and context and focuses on identifying

context–mechanism–outcome (CMO) configurations (Pawson & Tilley, 1997; Pawson et al., 2005). The context of action refers to interpersonal and social relationships connected to situations and localities. Mechanisms demonstrate how participants interpret and act on interventions. The mechanism is considered “constraining” when an intervention fails participants, leading to the desired outcome, and “enabling” when an intervention thrives in a particular context. Outcomes are expected from interventions (Pawson & Tilley, 1997). Existing systems can be addressed in component elements in an action context through CMO configurations of program theories that realistically evaluate the roots. They are based on the following assumption: “If we deliver a program in this way or we manage services like so, then this will bring about some improved outcome” (Pawson et al., 2005).

The study utilized the web usability test (Tullis & Stetson, 2004), content quality evaluation (Neumann, 2020), and in-depth interviews to conduct RE of online KT of APA. Figure 1 shows a schematic illustration of the study design using RE to evaluate each stage of KT.

Figure 1. Study design within the RE framework

(CF: Context Factor, O: Outcome)



2.2. Research Participants

Participants were recruited via the network of Korea Differently Abled Federation. The introduction of the research for recruitment was distributed to rehabilitation centers, middle and high schools, and multiple developmental disability networks. The participants were sampled according to the inclusion criteria. The study included 15 pairs (30 persons), consisting of a person with developmental disabilities (attendee) and their primary caregivers. All participants were Koreans who spoke Korean as their mother tongue. All participants reported being experienced with computers, smartphones, and the Internet, as well as daily usage of smartphones for everyday living and leisure purposes. Table 2 shows the demographic information, including the age and gender of the caregiver and the attendee pair, types of disability, and frequently used web services and mobile applications by the attendee.

Table 2. Demographic information and characteristics of the participants

Primary Caregiver (Age, Gender)	Attendee (Age, Gender)	Types of disabilities of the attendee	Frequently used mobile service of the attendee
Pair 1 55, Female	29, Male	Moderate Autistic Spectrum Disorder	YouTube, Candy Crush Saga
Pair 2 55, Female	30, Male	Mild Intellectual Disabilities and Brain Lesion	YouTube, Fruits Ninja
Pair 3 56, Female	26, Male	Mild Autistic Spectrum Disorder	YouTube, Tetris
Pair 4 67, Female	39, Male	Down Syndrome	YouTube, Candy Crush Saga
Pair 5 56, Female	26, Male	Moderate Autistic Spectrum Disorder	YouTube, Candy Crush Saga
Pair 6 52, Female	31, Female	Mild Intellectual Disabilities	YouTube, Melon (Music streaming platform)
Pair 7 52, Female	20, Female	Mild Intellectual Disabilities and Brain Lesion	YouTube
Pair 8 64, Female	38, Female	Mild Autistic Spectrum Disorder	YouTube, Naver (Search engine)
Pair 9 57, Female	31, Female	Mild Intellectual Disabilities	FLO (Music streaming platform), Naver
Pair 10 60, Female	28, Male	Mild Intellectual Disabilities and Brain Lesion	YouTube
Pair 11 61, Female	33, Female	Mild Intellectual Disabilities	YouTube, Naver, 3D Mobile Bowling Game, Kakaotalk (Messenger)
Pair 12 70, Female	32, Female	Mild Intellectual Disabilities	Naver, Candy Crush Saga, Kakaotalk
Pair 13 31, Male	15, Male	Moderate Autistic Spectrum Disorder	YouTube, various mobile games, Kakaotalk
Pair 14 54, Female	28, Female	Mild Intellectual Disabilities	Facebook
Pair 15 45, Female	18, Male	Mild Autistic Spectrum Disorder	YouTube, Kakaotalk

The participants were verbally informed about the research objectives and procedures using paper materials prior to each test and interview, and they signed a consent form. All participants were notified that they could terminate the test or interview at any time. The participants were also told that their identifiable information would be removed from the publication.

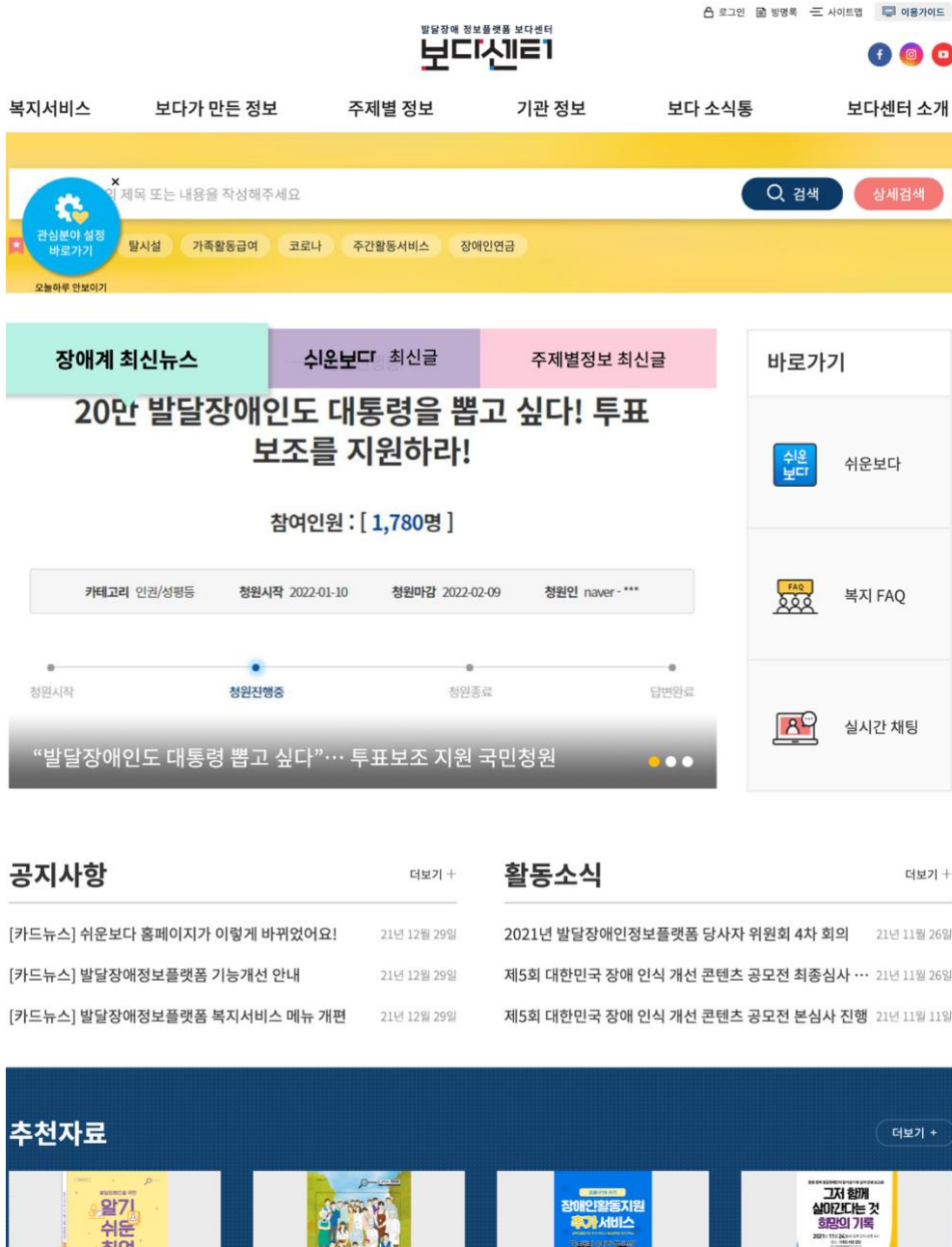
2.3. Web Usability Test

Usability testing is a technique that demonstrates and investigates the usability of a platform (Hussain, 2017; Sharpe, Rogers, & Preece, 2007). It specifies whether a platform meets a quantifiable usability standard when a specific user performs a given task using that platform (Khomokhoana, 2011). Web usability is essential in delivering information because the knowledge of users' interaction with the platform decides whether they retrieve the desired information successfully (Li et al., 2021; Baeza-Yates & Ribeiro-Neto, 2011).

For the usability evaluation, three web-based APA platforms targeting people with developmental disabilities were selected based on the following inclusion criteria: 1) an independent platform adapted for people with developmental disabilities and 2) a platform that contained various APA content in the form of embedded videos. Platforms that displayed APA content only in external hyperlinks to YouTube were excluded. The selected platforms were 1) BODA center, an information platform for developmental disabilities (BODA), 2) Un-tact Para Sports Gyeonggi (UPSG), and 3) DAMOA, content for people with developmental disabilities (DMOA). BODA was built and managed by the Korea Parents Network for the People with Disabilities, UPSG by Para Sports Gyeonggi, and DMOA by the Korea Communications Commission and Community Media Foundation. The

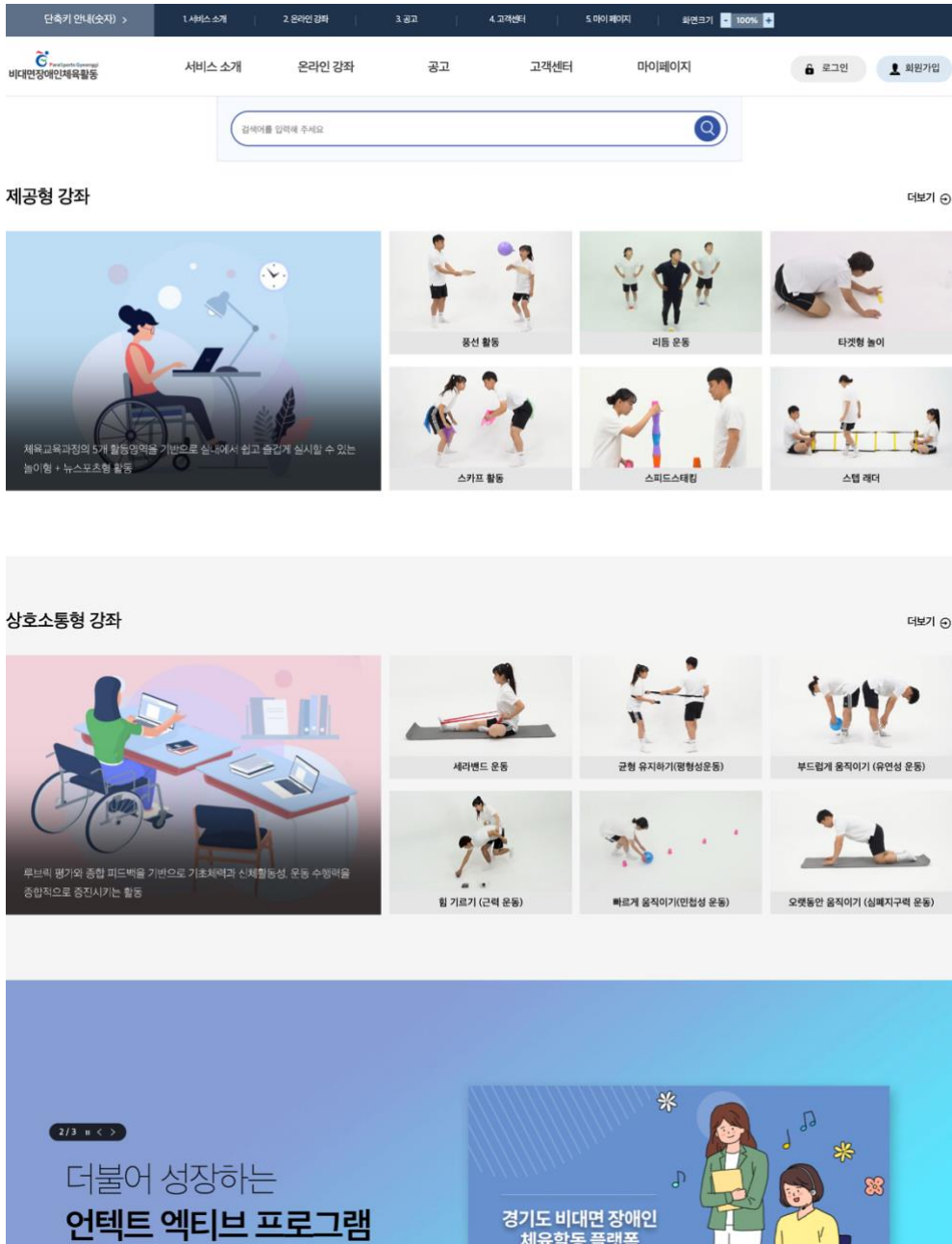
landing pages of the three websites are shown in Figures 2, 3, and 4.

Figure 2. The landing Page of BODA



Note: The title logo is located at the top center. The dropdown navigation menu is located right below the logo. The search window is in the yellow box with example keywords. Recent news is shown in slides in the center next to direct links. Two bulletin boards are right beneath the slides.

Figure 3. The landing page of UPSG



Note: The title logo is located at the left of the page, right next to the top navigation bar. All the contents are aligned within an inline block layout. All texts are supplemented with pictures and illustrations.

Figure 4. The landing page of DMOA



Note: The title logo is located at the left of the page, right next to the top navigation bar. The search window includes keyword recommendations with drawings. The contents' thumbnails and titles are displayed in multiple rows.

Web usability was assessed using the Web Usability Questionnaire developed by Tullis and Stetson (2004). The questionnaire consisted of nine questions scored on a 7-point Likert scale (-3, -2, -1, 0, 1, 2, 3), and it was proven valid and reliable in Tullis and Stetson's study (2004). The questionnaire was translated into Korean by the researcher and reviewed by two professors with more than 15 years of experience in the field of web usability. The questionnaire is shown in Table 3.

Table 3. Web usability questionnaire

1	This website is visually appealing
2	It was easy to move from one page to another
3	The overall organization of the site is easy to understand
4	Individual pages are well designed
5	Terminology used in this website is clear
6	The content of the website met my expectations
7	I would be likely to use this website in the future
8	I was able to complete my task in a reasonable amount of time
9	Overall, the website is easy to use

The participants conducted an assessment on web usability and proceeded to an in-depth interview. Both the attendees and the caregivers were instructed to navigate the designated platforms freely; the procedure was carried out to remove variables derived from website familiarity. Then the specific task was given: to find APA content on the platform and perform along with the video content. Each attendee and the caregiver had to execute

the task on one's own. If the attendee had too much difficulty executing the task, the caregiver could provide a verbal hint to the attendee. The task terminated when the attendee wished to terminate. The researcher used the 'thinking aloud' method to thoroughly investigate the usability of the platforms. Thinking aloud is the concurrent verbalization of thoughts while performing a task (Ericsson & Simon, 1993). The participants were told to report every thought and action that happened spontaneously without interpretation or analysis. The researcher recorded and closely monitored all the actions the participants took on each platform to analyze barriers in navigation. The caregiver scored the web usability reflecting upon the user experience of both the caregiver him/herself and the attendee.

2.4 Two-on-one in-depth interviews

All participants were involved in two-on-one in-depth interviews after the web usability evaluation. An interview was conducted to find out the details of the perceived web usability and content quality. The researchers employed a semi-structured interview along with the quantified test results to collect detailed information on the online KT of APA. The interview questions were structured within the KT framework with background questions to closely explore the context of actions, enabling and constraining mechanisms, and expected outcomes in each category. The semi-structured interview questions are displayed in Table 4.

Table 4. The semi-structured interview questions

1	Background questions	Which APA programs did you[attendee] participate recently (both online and offline)?
		How did you feel?
2	PA content audiences	How does the attendee use computers and smartphones in daily life? Describe in detail (Messengers, social network services, games, etc.)
3		What was the first impression when you saw the website?
4		Did you feel interested and motivated to use the website to perform the given task? If not, why?
5		How did you feel when you could / could not complete the task? Did you feel sense of accomplishment / failure?
6		How satisfactory is the overall experience of user's journey (regarding the target audience)?

7	PA content messengers	Were you aware of website, or the organizations that built the website? If yes, how did you get to know?
8		What could the disabilities organizations can do better to distribute appropriate PA knowledge for people with developmental disabilities?
9		What kind of accommodation alleviates understanding of textual contents (i.e. photos, illustrations, or drawings)?
10	PA content methods	What kind of knowledge and to which extent do you expect to attain online?
11		What kind of format (including online platforms) is appropriate to deliver the knowledge of APA to the target audience and why?
12		In which motivated to participate in online APA programs?
13	PA content improvement	Have you ever sent feedback regarding APA content to the creators / related organizations? How do you feel about communication network between you and content stakeholders?
14		What can be done to improve the overall online experience of APA to convey the professional knowledge toward the target audience?

2.5. Content quality evaluation

The content quality of each platform was assessed using the content quality evaluation rubric developed by Neumann (2020). The evaluation consisted of four categories: target appropriateness, content quality, design features, and learning objectives. Target appropriateness refers to a target's developmental maturity and capabilities related to understanding or processing content from screen media experiences. Content quality demonstrates making meaning from media or messages and actions screen media may promote, such as target-friendly and non-violent images. Design features aim to assess a video's structural characteristics and technical features, which represent how the content is presented to the target audience (e.g., animations and text alignment with a narration or song). Learning objectives determine what the target may learn or acquire from interacting with the video in relation to cognitive, physical, and social-emotional skills and capabilities (Neumann, 2020).

These categories were designed to assess the educational quality of videos. The main categories were divided into 17 sub-criteria. The subcriteria are listed in Table 3. A 3-point scoring system was used to assess each question and produce a total numeric assessment per video: No = no evidence (score = 0 points), Partial evidence (score = 1 point), or Yes = ample evidence (score = 2 points). The total scores were calculated by

summing the sub-criteria scores (maximum score = $17 \times 2 = 34$). The overall quality rating classification of a given video is as follows: $0 < 17$, not recommended, and 17 to 34, recommended for viewing by people with developmental disabilities (Neumann, 2020). The evaluation subcategories were tailored to meet the objectives of this study (Table 5).

Table 5. Content quality evaluation rubric

Criteria	Sub-criteria (Evaluation Questions)	0 No	1 Partial evidence	2 Yes
Target appropriat eness	(1) Can the target imitate the content presented (e.g. repeat a song, make body movements or gestures)?			
	(2) Does the content share similarities with the target (e.g., age, gender, interests)?			
	(3) Is the behavior on-screen positive (e.g., ethical, fair, caring, moral, non-violent, non-scary, healthy)?			
	(4) Does the on-screen behavior receive appropriate reinforcement (e.g., positive behavior is praised or encouraged, and negative behavior is discouraged)?			
Content quality	(5) Are social relationships accurately represented (e.g., gender and cultural stereotypes, power relationships)?			
	(6) Does the video encourage the target to perform creative tasks, solve problems or provide alternative ideas or ways of doing things?			
	(7) Does the video encourage the target to repeat content?			
	(8) Are the images, audio, sounds and language used appropriately for the target (i.e. the target can understand the content)?			

-
- Design features**
- (9) Is each scene clear, logical, and easy to follow?
 - (10) Is some content repeated during the video (e.g., to reinforce learning in positive ways)?
 - (11) Is there low and gradual pace with infrequent scene and character changes?
 - (12) Are pictures/graphics/animations presented alongside words/narration?
 - (13) Is conversational style used in wording (oral and written)?
 - (14) Are learning elements highlighted in the video?

-
- Learning objectives**
- (15) Does the video support cognitive development (e.g., language, literacy, lifeskill knowledge)?
 - (16) Does the video support physical development (e.g., gross and fine motor skills)?
 - (17) Does the video support socio-emotional development (e.g., fosters positive relationships, communication skills, moral attitudes, resilience, self-regulation, self-confidence)?

Total Score

Quality Rating 0 to < 17: Not Recommended; 17 to 34: Recommended

Five video contents on APA on each platform were assessed. These videos were selected because 1) they were the search result of the keyword “physical activity on each platform,” 2) the videos intended to instruct the audience on PA, and 3) the content was made for people with developmental disabilities.

Two independent raters pilot through a draft assessment manual to agree on a detailed assessment procedure for each subcategory to ensure inter-rater reliability. Subsequently, two raters assessed the content quality of the videos embedded in the target platforms using specific instructions. Inter-rater reliability was calculated using Cohen’s kappa (Neumann, 2020), which was 0.67, indicating that the raters reached a substantial agreement. The points of controversy were then explored in depth. After two raters agreed on the disagreed items, the final agreed-upon scores were used.

2.6. Research Process

The participants engaged in the web usability test and in-depth interviews. They first assessed web usability and immediately proceeded to an interview. The process of the web usability test was as follows: both the attendees and caregivers were instructed to navigate the designated platforms freely; the procedure was carried out to remove variables derived from website familiarity. Then, a specific task was given: finding the APA content on the platform and performing along with the video content. Each attendee and caregiver had to execute the task independently. If the attendee had too much difficulty completing the task, the caregiver could provide a verbal hint to the attendee (without physical intervention). The task was terminated when the attendee wished to end. The researcher used the “thinking aloud” method to thoroughly investigate the usability of the platforms. Thinking aloud is the concurrent verbalization of thoughts while performing a task (Ericsson & Simon, 1993). The participants were told to report every thought and action that occurred spontaneously without interpretation or analysis. The researcher recorded and closely monitored all the participants’ actions on each platform to analyze barriers to navigation. The caregiver scored web usability based on the user experience of both the caregiver and attendee. During the interview, participants were asked about details on web usability (e.g., visual interface, layout design, use of language, and impressions about content) and content quality of each

website to excavate a deeper context of KT to supplement the quantified results from the questionnaire and rubric.

Chapter 3. Results

Figure 5 demonstrates web usability scores, and Table 6 shows the result of the content quality evaluation of BODA, UPSG, and DMOA. In the descriptive statistics of the web usability evaluation, BODA scored significantly lower than UPSG and DMOA on all items. However, the UPSG and DMOA show significant differences in items 1, 2, and 3—visual appeal, page navigation, and organization. The difference in item 3 derives from the characteristics of the platform; UPSG only displays online APA programs, while DMOA curates content from various topics.

Figure 5. Web usability scores (all)

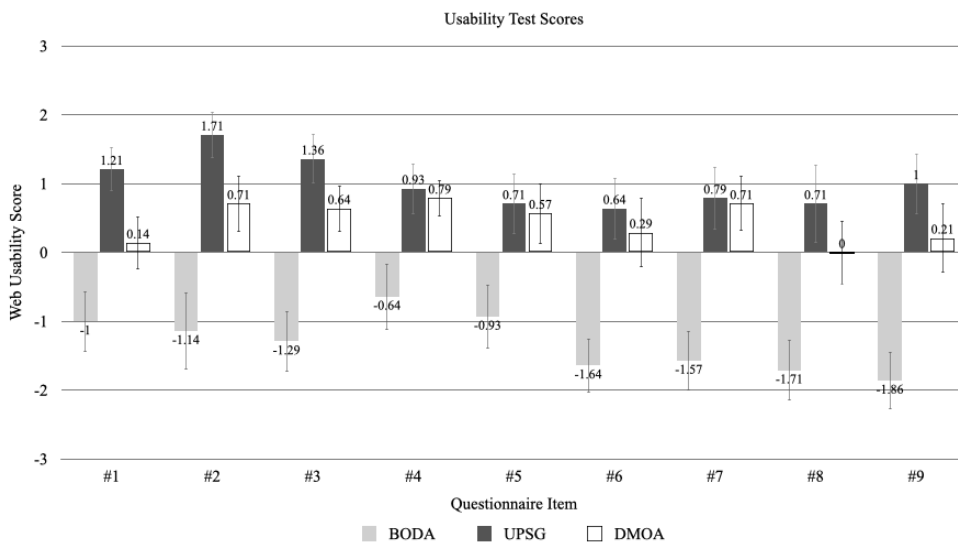


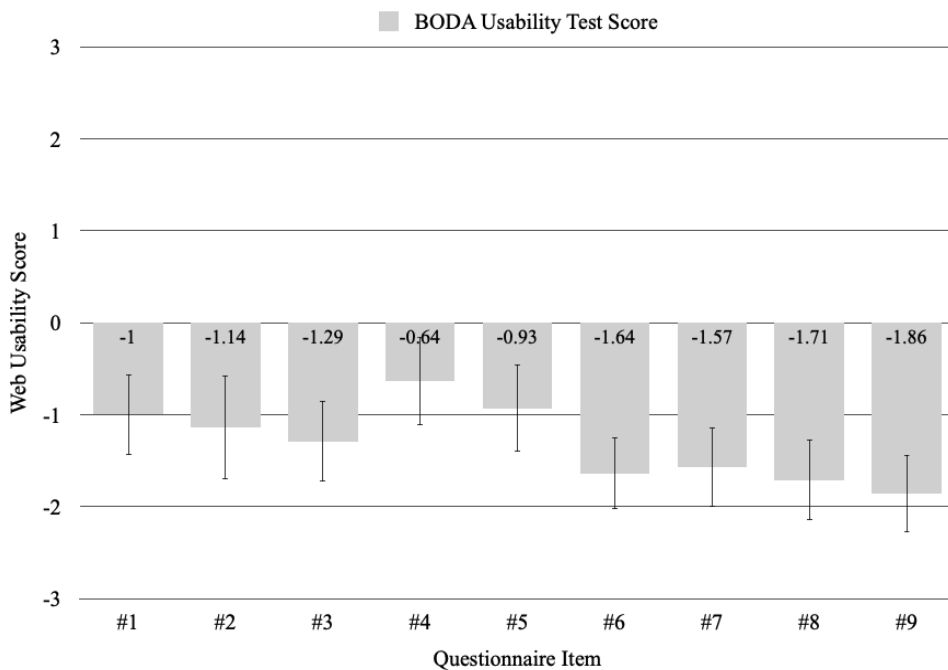
Table 6. Content quality evaluation (all)

Criteria	Sub-criteria (Evaluation Questions)	BODA Mean (SD)	UPSG Mean (SD)	DMOA Mean (SD)
Target appropriateness	1 Can the target audience imitate the content presented (e.g., repeat a song, make body movements or gestures)?	1.2(0.45)	2(0)	1.2(0.83)
	2 Does the content share similarities with the target (e.g., age, gender, interests)?	0.2(0.45)	1(0)	1.2(0.44)
	3 Is the on-screen behavior positive (e.g., ethical, fair, caring, moral, non-violent, non-scary, healthy)?	2(0)	2(0)	1.6(0.54)
	4 Does the on-screen behaviour receive appropriate reinforcement (e.g., positive behavior is praised or encouraged and negative behavior is discouraged)?	0.4(0.55)	0.6(0.54)	1.8(0.44)
Content quality	5 Are social relationships accurately represented (e.g., gender and cultural stereotypes, power relationships)?	1.6(0.55)	1(0)	1.2(0.44)
	6 Does the video encourage the target to perform creative tasks, solve problems, or provide alternative ideas or ways of doing things?	0.2(0.45)	0.4(0.54)	2(0)
	7 Does the video encourage the target audience to repeat content?	0.4(0.89)	1.6(0.54)	1.4(0.54)
	8 Are the images, audio, sounds, and language used appropriately for the target audience (i.e., the target audience can understand the content)?	1.8(0.45)	1.4(0.54)	1.6(0.54)
Design features	9 Is each scene clear, logical, and easy to follow?	1(0)	2(0)	1.8(0.44)
	10 Is some content repeated during the video (e.g., to reinforce learning in positive ways)?	0.8(1.10)	1.6(0.54)	1.8(0.44)
	11 Is there low and gradual pace with infrequent scenes and character changes?	0.6(0.89)	2(0)	1.4(0.54)
	12 Are pictures/graphics/animations presented alongside words/narration?	1.2(0.45)	1.8(0.44)	2(0)
	13 Is conversational style used in wording (oral and written)?	2(0)	1(0)	2(0)
	14 Are learning elements highlighted in the video?	0.8(1.10)	1.2(0.44)	1.8(0.4)
Learning objectives	15 Does the video support cognitive development (e.g., language, literacy, and life skill knowledge)?	0.2(0.45)	1(0)	1.4(0.54)
	16 Does the video support physical development (e.g., gross and fine motor skills)?	0.8(1.10)	2(0)	1.6(0.54)
	17 Does the video support socio-emotional development (e.g., fosters positive relationships, communication skills, moral attitudes, resilience, self-regulation, self-confidence)?	1.6(0.55)	1(0)	1.6(0.54)
Total Score		16.8(5.22)	23.6(0.89)	27.4(1.67)

3.1 BODA (<https://www.boda.or.kr/>)

BODA aims for a wide-ranging content platform as well as a search engine for people with developmental disabilities. BODA scored less than zero on all questionnaire items on the usability test. The lowest score was -1.86 on item 9, asking about the overall ease of use of the website. The highest was -0.64 on item 4 regarding the design of the individual pages (Figure 6).

Figure 6. Web usability scores (BODA)



Only 4 out of 15 pairs executed the given task successfully, indicating that the platform's interface and navigation are not learnable. The participants stated that the bright and pop colors used in the interfaces seemed interesting. Still, the layout of the landing page was too complicated, and the interfaces [buttons] were unintuitive and indistinguishable. The

attendees typed keywords in the search box to execute a specific task, such as physical activity, exercise, and sports; however, the search results were inconsistent and did not meet expectations. The caregivers reported the websites to seem like they were not built for the knowledge users since the platform completely lacked understanding of people with developmental disabilities.

Table 7. Content quality evaluation (BODA)

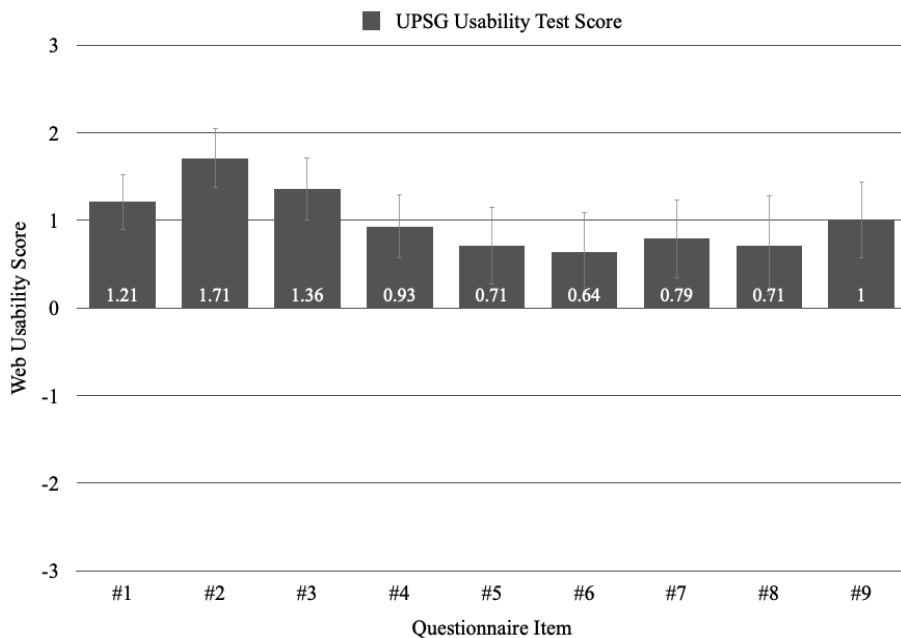
Criteria	Sub-criteria (Evaluation Questions)	Mean (SD)
Target appropriateness	1 Can the target imitate the content presented (e.g. repeat a song, make body movements or gestures)?	1.2(0.45)
	2 Does the content share similarities with the target (e.g., age, gender, interests)?	0.2(0.45)
	3 Is the behaviour on-screen positive (e.g., ethical, fair, caring, moral, non-violent, non-scary, healthy)?	2(0)
	4 Does the on-screen behaviour receive appropriate reinforcement (e.g., positive behaviour is praised or encouraged, and negative behaviour is discouraged)?	0.4(0.55)
Content quality	5 Are social relationships accurately represented (e.g., gender and cultural stereotypes, power relationships)?	1.6(0.55)
	6 Does the video encourage the target to perform creative tasks, solve problems or provide alternative ideas or ways of doing things?	0.2(0.45)
	7 Does the video encourage the target to repeat content?	0.4(0.89)
	8 Are the images, audio, sounds and language used appropriately for the target (i.e. the target can understand the content)?	1.8(0.45)
	9 Is each scene clear, logical, and easy to follow?	1(0)
Design features	10 Is some content repeated during the video (e.g., to reinforce learning in positive ways)?	0.8(1.10)
	11 Is there low and gradual pace with infrequent scene and character changes?	0.6(0.89)
	12 Are pictures/graphics/animations presented alongside words/narration?	1.2(0.45)
	13 Is conversational style used in wording (oral and written)?	2(0)
	14 Are learning elements highlighted in the video?	0.8(1.10)
Learning objectives	15 Does the video support cognitive development (e.g., language, literacy, and lifeskill knowledge)?	0.2(0.45)
	16 Does the video support physical development (e.g., gross and fine motor skills)?	0.8(1.10)
	17 Does the video support socio-emotional development (e.g., fosters positive relationships, communication skills, moral attitudes, resilience, self-regulation, self-confidence)?	1.6(0.55)
Total Score		16.8 (5.22)

The APA content of BODA was assessed as “not recommended” in the content quality evaluation, scoring 16.8 (Table 7). The content did not meet the expectations of target appropriateness and learning objectives. The BODA content failed to reinforce target behaviors to the target audience in an appropriate manner. The content also failed to demonstrate clear objectives for supporting cognitive and physical development. The participants reported that they did not find the content interesting or encouraging to participate in PA due to a lack of instructions and proper reinforcement. Caregivers stated that they could not tell the difference between the BODA content and other content on PA for people without disabilities, implying that the content creators lacked knowledge of people with developmental disabilities.

3.2 UPSG (언택트경기도장애인체육회.com [service terminated in 2022])

The UPSG is an inclusive platform explicitly designed to deliver APA information. The content composition and navigation of the platform are relatively straightforward owing to its nature; hence, all the participants executed the given tasks successfully. Accordingly, the UPSG scored above zero for all the items in the usability test. Item 2 scored the highest (1.67) for navigation from one page to another. Item 6 scored the lowest (0.60), demonstrating satisfaction regarding the expected content on the platform. See Figure 7 for a detailed description of these statistics.

Figure 7. Web usability scores (UPSG)



Against high scores on the usability test, the attendees and caregivers reported that a clear hierarchy and layout made the platform substantially learnable; however, the attendees were not likely to be

motivated to participate in the online programs due to a lack of entertainment in the design elements. The caregivers also stated that the use of photography as a visual aid to support the text information helped the attendees understand the text's meaning and the PA programs' content. However, the caregivers believed that the attendees would not likely use the website voluntarily in the future because the platform only contained educational APA content, which they did not perceive as entertaining or enjoyable.

The APA programs of the UPSG were assessed as “recommended” in the content quality evaluation, scoring 23.6 (Table 8). The video content in the UPSG demonstrated a consistent structure and clear physical objectives. However, the attendees reported having difficulty understanding the goals in the content due to the verbal use of professional vocabulary. The caregivers stated that the frequency and duration of modeling were insufficient for the attendees to learn. Thus, they were likely to give up halfway because they could not imitate screen behavior.

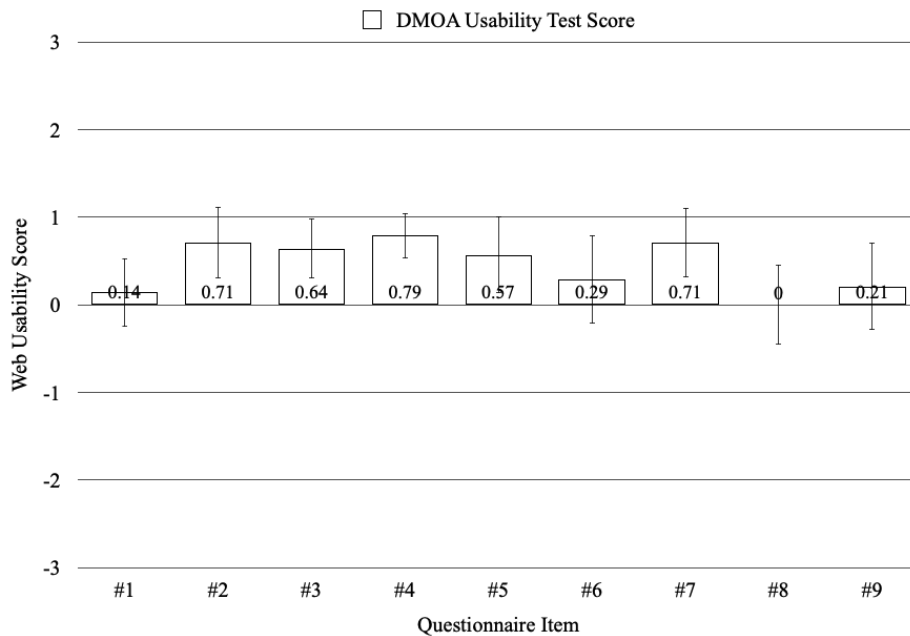
Table 8. Content quality evaluation (UPSG)

Criteria	Sub-criteria (Evaluation Questions)	Mean (SD)
Target appropriateness	1 Can the target imitate the content presented (e.g. repeat a song, make body movements or gestures)?	2(0)
	2 Does the content share similarities with the target (e.g., age, gender, interests)?	1(0)
	3 Is the behaviour on-screen positive (e.g., ethical, fair, caring, moral, non-violent, non-scary, healthy)?	2(0)
	4 Does the on-screen behaviour receive appropriate reinforcement (e.g., positive behaviour is praised or encouraged, and negative behaviour is discouraged)?	0.6(0.54)
Content quality	5 Are social relationships accurately represented (e.g., gender and cultural stereotypes, power relationships)?	1(0)
	6 Does the video encourage the target to perform creative tasks, solve problems or provide alternative ideas or ways of doing things?	0.4(0.54)
	7 Does the video encourage the target to repeat content?	1.6(0.54)
	8 Are the images, audio, sounds and language used appropriately for the target (i.e. the target can understand the content)?	1.4(0.54)
	9 Is each scene clear, logical, and easy to follow?	2(0)
Design features	10 Is some content repeated during the video (e.g., to reinforce learning in positive ways)?	1.6(0.54)
	11 Is there low and gradual pace with infrequent scene and character changes?	2(0)
	12 Are pictures/graphics/animations presented alongside words/narration?	1.8(0.44)
	13 Is conversational style used in wording (oral and written)?	1(0)
Learning objectives	14 Are learning elements highlighted in the video?	1.2(0.44)
	15 Does the video support cognitive development (e.g., language, literacy, and lifeskill knowledge)?	1(0)
	16 Does the video support physical development (e.g., gross and fine motor skills)?	2(0)
	17 Does the video support socio-emotional development (e.g., fosters positive relationships, communication skills, moral attitudes, resilience, self-regulation, self-confidence)?	1(0)
Total Score		23.6 (0.89)

3.3 DMOA (<https://www.damoa.or.kr>)

The DMOA displayed a wide variety of curated content for people with developmental disabilities. The DMOA scored above zero on eight items and below zero on one item. Item 4, related to the design of individual pages, scored the highest (0.8); item 8, associated with the learnability of the platform, scored the lowest (-0.07) (see Figure 8).

Figure 8. Web usability scores (DMOA)



Twelve pairs out of 15 executed the given task successfully, implying that the platform was moderately learnable. The caregivers stated that simple illustrations along with the text acted as an adaptation to help the target audience understand the meaning of the text and provided entertainment to attract the attendees' attention and actions. The attendees,

however, stated that the curation categories were confusing; the category keywords did not have a consistent pattern or hierarchy (e.g., how to use a phone, pimples, theaters, and how to make friends).

The APA content of the DMOA was evaluated as “recommended,” scoring 27.4 (Table 9). The content was structured, created, and edited in a consistent manner, conversational language appropriate for the attendees was used, and relevant design elements were implemented, including pictures, graphics, animations, and subtitles. The participants were moderately satisfied with the content of the DMOA because the platform contained various informative content pursuing educational entertainment in an easy-to-understand format. However, one caregiver pointed out that the platform contained inappropriate and dangerous leisure content, such as playing with fire; she added that the platform needed to curate the content under consideration for safety.

Table 9. Content quality evaluation (DMOA)

Criteria	Sub-criteria (Evaluation Questions)	Mean (SD)
Target appropriateness	1 Can the target imitate the content presented (e.g. repeat a song, make body movements or gestures)?	1.2(0.83)
	2 Does the content share similarities with the target (e.g., age, gender, interests)?	1.2(0.44)
	3 Is the behaviour on-screen positive (e.g., ethical, fair, caring, moral, non-violent, non-scary, healthy)?	1.6(0.54)
	4 Does the on-screen behaviour receive appropriate reinforcement (e.g., positive behaviour is praised or encouraged, and negative behaviour is discouraged)?	1.8(0.44)
Content quality	5 Are social relationships accurately represented (e.g., gender and cultural stereotypes, power relationships)?	1.2(0.44)
	6 Does the video encourage the target to perform creative tasks, solve problems or provide alternative ideas or ways of doing things?	2(0)
	7 Does the video encourage the target to repeat content?	1.4(0.54)
	8 Are the images, audio, sounds and language used appropriately for the target (i.e. the target can understand the content)?	1.6(0.54)
	9 Is each scene clear, logical, and easy to follow?	1.8(0.44)
Design features	10 Is some content repeated during the video (e.g., to reinforce learning in positive ways)?	1.8(0.44)
	11 Is there low and gradual pace with infrequent scene and character changes?	1.4(0.54)
	12 Are pictures/graphics/animations presented alongside words/narration?	2(0)
	13 Is conversational style used in wording (oral and written)?	2(0)
	14 Are learning elements highlighted in the video?	1.8(0.4)
Learning objectives	15 Does the video support cognitive development (e.g., language, literacy, and lifeskill knowledge)?	1.4(0.54)
	16 Does the video support physical development (e.g., gross and fine motor skills)?	1.6(0.54)
	17 Does the video support socio-emotional development (e.g., fosters positive relationships, communication skills, moral attitudes, resilience, self-regulation, self-confidence)?	1.6(0.54)
Total Score		27.4 (1.67)

3.4 Analysis

Table 10 demonstrates an explanative analysis of web usability based on the observation and interview along with the test scores. Enabling and constraining mechanisms for the domains of web usability on each platform are described. Web usability analysis is demonstrated in five domains: user interface, layout, navigation, language, and contents. In terms of the user interface, participants considered the search window and floating action unnecessary. It was also observed that none of the participants perceived or attempted to use those interfaces to search for information. BODA's use of bright and pop colors acted as enabling mechanism, while indistinguishable and unclickable buttons acted as constraining mechanisms. Participants were confused due to distractions from too many designed features on a single item. For UPSG, all textual information was aided with photographs, facilitating understanding of content. However, dull colors were pointed out as the constraining mechanism hindering users from revisiting the website. Regarding layout, UPSG was praised for clear content alignment and exhibiting only necessary features on the page. However, both BODA and DMOA failed to execute a fully responsive layout. BODA provided the worst navigation experience for the users. Participants failed to reach the expected result from navigations. UPSG had an intuitive navigation process, providing explicit affordance on where to click. BODA and UPSG used professional terminology on the website,

which frustrated the participants from engaging in further online activities. Appropriate use of language in DMOA acted as enabling mechanism to retain the users. UPSG had a clear contents hierarchy in APA programs since the website's primary goal was to provide APA programs online for people with developmental disabilities.

Table 11 presents a detailed analysis of the content quality evaluation for each platform. The content of BODA lacked a consistent structure and format and displayed unclear messages on the objective of the content, resulting in indistinguishable content for people without disabilities. The content of UPSG showed clear goals with proper design elements; however, it used professional vocabulary that the attendees could not understand. Finally, the content of DMOA used appropriate conversational language and design elements; however, it displayed unclear messages regarding the purpose of the content.

Table 10. Web usability analysis

Domain	BODA	UPSG	DMOA
User interface	<ul style="list-style-type: none"> + Use of bright and pop colors - Indistinguishable and unclickable buttons - Distraction due to too many design features on a single item 	<ul style="list-style-type: none"> + Texts aided with photographs - Invisible functions: notice, record keeping, share results, etc. - Use of boring colors 	<ul style="list-style-type: none"> + Texts aided with pictures and illustrations
	<ul style="list-style-type: none"> - (Common) Unnecessary interface: search window and floating action buttons 		
Layout	<ul style="list-style-type: none"> - Not fully responsive layout - Unclear instructions, categories, and hierarchy on the landing page 	<ul style="list-style-type: none"> + Clear content alignment + Sufficient information in an intuitive layout + Only necessary features on the page 	<ul style="list-style-type: none"> + Interesting impression with diverse video content on the landing page - Non-responsive texts and image layout - Too many contents in a single page
	Navigation	<ul style="list-style-type: none"> - Unmet expectations on search results - Unclear instructions, categories, and hierarchy throughout user journey 	<ul style="list-style-type: none"> + No need for search window to perform tasks + Clear affordance on where to click - Lack of a sitemap - Lack of content hierarchy in “notice” - Invisible functions: notice, record keeping, share results, etc.
Language		<ul style="list-style-type: none"> - Professional terminology - Too many foreign words that are rarely used in real life 	<ul style="list-style-type: none"> - Professional terminology
	Contents	<ul style="list-style-type: none"> - Inadequate content: contests and documents for civil servants - Search results consisting of press release materials 	<ul style="list-style-type: none"> + Clear contents hierarchy in APA programs + Well-structured APA programs based on academic evidence - Nothing but APA content is not attractive for target users
			<ul style="list-style-type: none"> + : Enabling mechanism - : Constraining mechanism

Table 11. Content quality analysis

Categories	BODA	UPSG	DMOA
1 Target appropriateness	<ul style="list-style-type: none"> - Inconsistent content format and structure - Insufficient understanding of developmental disabilities resulting in inadequate content development 	<ul style="list-style-type: none"> + Contents according to levels of development + Includes group activity and games to pursue interest - Includes professional explanation of effects of exercise which is not understandable and boring - Not enough repetitive modeling for the target to follow activities 	<ul style="list-style-type: none"> + Appropriate use of language for the target + Content development from various points of view on various topics regarding APA + Easy to understand without background knowledge - Not interesting enough to voluntarily participate in APA
2 Content quality	<ul style="list-style-type: none"> - Unclear messages on the objective of the program - Unclear messages on the pursuit of social, physical, and psychological skills in the content 	<ul style="list-style-type: none"> + Clear structure on APA programs based on the academic evidence + Clear goals on the objective of the activities - Too professional terminology 	<ul style="list-style-type: none"> + Contains various informative contents pursuing entertainment - Includes inappropriate content that is very dangerous to model
3 Design features	<ul style="list-style-type: none"> + Simple drawings are included to draw attention from the target audience 	<ul style="list-style-type: none"> + Essential design elements to help the target audience understand the content + Lack of entertaining design features (drawings, characters, etc.) to draw attention and pursue entertainment 	<ul style="list-style-type: none"> + Use of characters and drawings with footages to draw attention + High-quality animations, 2D graphics, 3D graphics, and editing - Inappropriate thumbnails: difficult titles and boring images
4 Learning objectives	<ul style="list-style-type: none"> - Indistinguishable from content targeting people without disabilities 	<ul style="list-style-type: none"> + Clear objectives on physical and social development via APA 	<ul style="list-style-type: none"> - Vague messages: information delivery, APA participation

+ : Enabling mechanism
 - : Constraining mechanism

Chapter 4. Discussion

This study demonstrates the knowledge-to-action gap in APA among people with developmental disabilities by evaluating online KT. In addition, the results show why and how academic knowledge of APA is not adequately delivered to people with developmental disabilities via online platforms. The results from the web usability test, content quality test, and in-depth interviews were restructured within the KT framework proposed by Lavis et al. (2003) for RE. The caregivers were unaware of the information messengers prior to the research; hence, they did not engage in online programs provided by the messengers. The participants believed that low engagement in online PA was due to inappropriate content and platform development by knowledge creators, along with insufficient promotions from the messengers. Several studies explored efficient ways of delivering information to people with limited literacy (Son et al., 2019; Callus & Cauchi, 2020; Sutherland & Isherwood, 2016); however, academic findings have not been adequately applied to current websites developed for people with developmental disabilities. Moreover, PA content on the platforms was educational but failed to motivate attendees to participate in the programs voluntarily. The state-of-the-art in online APA has much room for improvement through trial and error. Nevertheless, the caregivers believed that the communication network between knowledge users and creators was one-sided, users did not know where to leave feedback, and creators did not

have channels to receive feedback from users. See Table 12 for a detailed description of the RE of online KT in APA.

Table 12. RE of online KT

KT Framework	Realistic Evaluation	
PA content audiences	Context of action	Reaching social agreement on needs of appropriate form of knowledge and information via online domains in context of equality and welfare
	Mechanism	<ul style="list-style-type: none"> + Visual aid such as pictures and photographs with text in the web interface. + Kind and careful explanations consisting of easy words & repetitive modeling - Inappropriate use of language - Insufficient background knowledge of content creators in people with developmental disabilities - Participants' lack of interest in the contents
	Outcome	Inappropriate content development, thus low participation in PA of the target
PA content messengers	Context of action	Primary caregivers are aware of the messengers (developmental disability organizations and networks). They feel the messengers are passive and inactive.
	Mechanism	<ul style="list-style-type: none"> + Promotions from developmental disability networks - Helpless caregivers: a lack of presentation of professional knowledge regarding the disabilities and lifespan development - Trustworthiness of content from organizations: lack of evidence presentation in APA programs and content, lack of structure and standards in APA content
	Outcome	Despite prior knowledge, the caregivers do not engage in any kind of online programs and activities hosted by the messengers.
PA content methods	Context of action	Academic research on easy-read and video modeling
	Mechanism	<ul style="list-style-type: none"> + Video modeling and adaptation for the target audience + Arousal of interest: linkage with familiar culture (K-pop, Pop celebrities), virtual characters and animations + Autoplay and curated contents - Boring - Absence of content options according to development level - Context of "home": no voluntary participation when caregiver is absent
	Outcome	Not motivated to voluntarily participate in online PA
PA content improvement	Context of action	Current content has a lot of room for improvement through trial and error
	Mechanism	<ul style="list-style-type: none"> + Consensus on the need for online APA communication - Absence of communication channel - Primary caregivers' underlying skepticism about online APA contents
	Outcome	One-sided communication of stakeholders and content creators.

Based on the interview analysis, participants shared common thoughts on reaching social agreement on the need for appropriate knowledge online. However, content creators and online product builders lack an understanding of efficient knowledge delivery. As pointed out in the web usability result, visual aid, including pictures and photographs with textual information, would promote a better understanding of the content. The ultimate goal of KT is to draw organizational outcomes of the target users, that is, voluntary PA participation of people with developmental disabilities. To do so, academic researchers, product builders, and other stakeholders in KT should focus on developing methods to encourage the intrinsic motivation of the target user group. It was also agreed that all knowledge creators, translators, and users must have the patience to go through trial and error to improve the online KT of APA further.

Several studies have explored the barriers to and facilitators of the communication networks for APA information for people with disabilities (Tristani et al., 2017; Jaarsma et al., 2014, 2015, 2019). Previous studies have demonstrated that not receiving information could be one reason people with disabilities do not actively engage in online PA communication, resulting in not participating in PA (Jaarsma et al., 2019). Moreover,

messengers should develop online APA programs focusing on specific disabilities for appropriate care and management rather than providing universal programs for all kinds of disabilities and consider the physical and developmental dissimilarities between people with different disabilities (Rimmer & Braddock, 2002; Tristani et al., 2017). This study highlights the online KT of APA for people with developmental disabilities because previous studies focused more on physical disabilities than disabilities with limited literacy. The results of this study may provide suggestions for improving online communication to disseminate PA information by demonstrating the CMO configurations of online KT. Moreover, the research findings and insights contribute to building web accessibility guidelines for people with developmental disabilities.

There is a limitation to the current study. Participants were only observed performing PA during the trial. That is, the evidence acquired during the trial cannot fully reflect the actual practice in real life. It is suggested that future studies focus on observing the actual practice of APA for the intended population using online platforms. Moreover, detailed exemplar prototypes should be built and tested to create appropriately adapted platforms for users with developmental disabilities.

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초 록

홍 산

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지식 전환은 학술적 연구를 통해 창출된 지식을 실용적인 정보로 전환하는 반복적인 과정이다. 특수체육 학계의 활발한 연구 활동 및 지식 생산에도 불구하고 학술적 결과물이 발달장애인이 접근 가능한 정보의 형태로 전달되지 않아 지식-실천 격차가 발생한다. 본 연구는 Realistic evaluation (RE) 방법을 활용하여 한국 내 특수체육의 온라인 지식 전환을 알아보고자 한다. 발달장애인 당사자와 주 양육자 15쌍이 연구에 참여했다. 웹 사용성 테스트, 콘텐츠 품질 평가, 그리고 2:1 인터뷰를 통해 3개의 발달장애인 정보 플랫폼을 평가했다. 이 연구는 웹 사용성과 콘텐츠 질에 있어 사용자 맥락, 촉진 및 방해 요인, 그리고 이에 따른 결과를 보여준다. RE는 특수체육의 온라인 지식전환에서의 촉진 및 방해 요인을 규명하기 위해 지식 전환 프레임워크 안에서 진행되었다. 본 연구의 결과는 특수체육의 온라인 지식 전환 개선에 기여하여 발달장애인의 특수체육지식-실천 격차를 줄이리라 기대된다.

주요어 : realistic evaluation, 사용성, 콘텐츠 품질, 접근성

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