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Graphic Symbols: Improving or Impeding Comprehension of Communication Bill of Rights?

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Abstract

It is widely assumed that pairing graphic symbols with text will support text comprehension. This has led to the practice of coupling text with graphic symbols to make it more accessible and understandable. Unfortunately, there is little empirical evidence to support this assumption or practice. The current study investigated the use of single graphic symbols to convey the meaning of the 15 statements that comprise the Communication Bill of Rights. Fifty-two speech-language pathology graduate students that were enrolled in a graduate-level augmentative and alternative communication course participated. They were asked to determine the right conveyed by each of 15 graphic symbols in an open-ended task, and then to match the symbols to the corresponding statements in a multiple-choice task. Participants had limited success with both tasks regardless of year in school or previous experience with graphic symbols. Implications for the use of graphic symbols to support text comprehension are discussed.

Keywords: graphic symbols, assistive technology, literacy, symbol supported text.

Introduction

Decades of research have demonstrated that people with severe disabilities demonstrate significant difficulty learning to read (e.g., Conners, 2003; Erickson & Geist, 2016). School-aged students with intellectual and developmental disabilities (IDD) have low levels of reading achievement and take longer to make gains in reading than their peers without disabilities (Allor et al., 2014). As adults, individuals with IDD continue to struggle to read words and comprehend text (Jones et al., 2006). As a result, individuals with IDD often find it difficult if not impossible to access text (Hurtado et al., 2014). To address this challenge, the recommendation is often made to add pictures, pictograms, or graphic symbols to the text (e.g., Nomura et al., 2010; Office for Disability Issues, 2018). Individual pictures, pictograms, or graphic symbols can be selected to represent the meaning of an entire sentence, key ideas in a sentence, or all of the meaning and grammatical information in a sentence (Poncelas & Murphy, 2007). Unfortunately, there is little empirical support for any of these uses of pictures, pictograms, or graphic symbols to support text comprehension (Erickson et al., 2010; Hurtado et al., 2014). The purpose of this study was to investigate the use of individual graphic symbols to represent the meaning of each statement from the Communication Bill of Rights (Brady et al., 2016).

Graphic Symbols

There are many types of graphic symbols. Some are simple line drawings, some are abstract shapes, and others are colorful and detailed. Graphic symbols that clearly represent a referent are said to be transparent. Graphic symbols that are easily learned but not transparent are labeled translucent, and those that have no visual relationship to a referent are abstract or opaque (Beukelman & Mirenda, 2013). Graphic symbols that represent concepts (e.g., more, some, want) rather than objects or actions and those that represent grammatical function words (e.g., is, are, can) are necessarily abstract or opaque because those words are not easily represented by a picture.

Graphic symbols for expressive communication. For several decades, graphic symbols have been used extensively to support expressive communication for individuals with complex communication needs (Beukelman & Mirenda, 2013). In this context, graphic symbols can support individuals with IDD in augmenting or replacing their speech to communicate more effectively with others (Snell et al., 2010). When graphic symbols are used with individuals with complex communication needs to support expressive communication, the meaning of the symbols are generally taught directly by pairing them with the assigned referent (Isaacson & Lloyd, 2013) or indirectly through extensive demonstrations of their use (O'Neill et al., 2018). In either case, it is understood that individuals must learn the meaning of the symbols to use them effectively in expressive communication.

Graphic symbols for text access. Similarly, graphic symbols have been used in the context of literacy for many decades (e.g., Samuels, 1967); however, their use in the context of literacy has not been quite as successful (Erickson et al., 2010). For example, children (Singh & Solman, 1990) and adults (Pufpaff et al., 2000) with IDD can learn to read words paired with symbols, but it takes longer to learn to read a printed word when it is taught paired with a picture. Furthermore, the addition of graphic symbols to text

does little to support comprehension (e.g., Hurtado et al., 2014; Jones et al., 2006 Poncelas & Murphy, 2007). Nonetheless, guidelines regarding text accessibility continue to include recommendations for the inclusion of graphic symbols (e.g., Department of Health, 2010; Office for Disability Issues, 2018), and various stakeholders respond positively and enthusiastically to texts that are supported with graphic symbols (Parson & Sherwood, 2015).

The Current Investigation

The current investigation was prompted by a flurry of social media posts regarding an informational document called the Communication Bill of Rights (Brady et al., 2016), its accessibility, and the assumption that adding graphic symbols would make the document more accessible to individuals with IDD who have complex communication needs. Subsequent to that flurry of activity, numerous individuals and agencies began creating versions of the Communication Bill of Rights that had graphic symbols inserted (see: Lovatt, 2017). We were left with the question, *Do the graphic symbols support understanding of the Communication Bill of Rights?*

About the Communication Bill of Rights

The Communication Bill of Rights was developed by the National Joint Committee for the Communication Needs of People with Severe Disabilities (NJC), which is an interdisciplinary group founded to advocate for the communication needs of people with severe disabilities (http://www.asha.org/njc). An original Communication Bill of Rights was published in 1992 (National Joint Committee for the Communication Needs of Persons with Severe Disabilities) and a revised Communication Bill of Rights was published in 2016 (Brady et al., 2016).

Although the Communication Bill of Rights is designed to be a list of rights that professionals pledge to support when working to support the communication of individuals with IDD, there is also an interest in making sure that individuals with IDD understand their rights. As a result, the Communication Bill of Rights has been reprinted such that each right is represented by and paired with a graphic symbol (see: Lovatt, 2017). Presumably, this has been done to allow those who cannot read to understand each right, while improving understanding for others who can decode the words but not understand the meaning (Freyhoff et al., 1998).

The purpose of the current study was to understand whether the symbols chosen to represent each of the fifteen rights are decodable. Specifically, the study aimed to address two primary questions: (1) How well do literate adults who are familiar with graphic symbols and the purpose of the Communication Bill of Rights determine the content of each right based solely on the graphic symbol? and (2) How accurately can the same adults match each right with the graphic symbol that was selected to represent it?

Target Audience and Relevance

The audience for this paper includes special educators, speech-language pathologists, occupational therapists, assistive technology specialists and parents who find themselves tasked with supporting

students with IDD in accessing academic curriculum – including literacy instruction – or who find themselves advocating for increased access to text for individuals with IDD. This information may also be of interest to administrators and curriculum coordinators who make purchasing decisions that impact the text with which students interact with in the classroom.

Outcomes and Benefits

Despite Federal legislation mandating increased access to curriculum and standards-based instruction, students with IDD continue to have reduced opportunities to engage in literacy and print-based instruction in schools (Ruppar, 2015). The results of this study have the potential to impact the AT supports provided to students, so that they might enjoy increased access to text and increased success in understanding the text they do access.

Method

This study was approved by the Institutional Review Board of the university where the authors are employed.

Participant Recruitment

Graduate students in speech and language pathology who were enrolled in a semester-long course on augmentative and alternative communication were invited to participate in the study during class time. All first- and second-year master's students in speech and language pathology were enrolled in the course and all 52 consented to participate. As is expected in the field of speech-language pathology, most of the students identified as female (92.3%). The remaining students identified as male (5.8%) or other (1.9%). The students had a mean age of 25 but ranged in age from 21 to 33 years old. The students were evenly distributed between first (50%) and second year (48.1%) master's students, with one Ph.D. student (1.9%). Most students (76.9%) indicated they had prior experience and exposure to Picture Communication Symbols© from Mayer-Johnson (2006); however, for nearly all students, this course was their first focused on augmentative and alternative communication (98.1%). There were differences by year in the program in regard to exposure to Picture Communication Symbols © (Mayer-Johnson, 2006), with students in their second year being statistically significantly more likely to indicate that they had experience with them ($X2 (1) = 11.79$, $p = 0.00$). As such, differences between cohorts were investigated.

Selecting an Example Communication Bill of Rights

The process of selecting which graphic-symbol-supported Communication Bill of Rights to use in the current study began with an internet search to preview those that have been posted. After reviewing several dozen, the pool was narrowed down to those that retained the original wording of the Communication Bill of Rights. From that much smaller pool, we sought a version that had a single symbol representing each right. Our desire was to focus on a version that used symbols in a functional way rather than representing keyword or supporting word-by-word symbol reading (Poncelas & Murphy, 2007). That is, we wanted a version with a single symbol that was intended to represent the whole sentence, or, in the case of this study, the whole right. We could have selected a version with a keyword approach that

used symbols to represent all the key ideas in each right, or we could have selected or created a version that supported reading by pairing a symbol with each key idea and grammatical marker. In the end, we selected the AGOSCI Inc. (Lovatt, 2017) symbol-supported version of the Communication Bill of Rights (Brady et. al., 2016). Table 1, Picture Communication Symbol Representing Corresponding Right, displays the Picture Communication Symbols© from Mayer-Johnson (2006) and the rights they represent per the AGOSCI document.

Table 1: Picture Communication Symbol Representing Corresponding Right

Number	PCS Symbol	The right to…
1		Interact socially, maintain social closeness, and build relationships
2		Request desired objects, actions, events, and people
3		Refuse or reject undesired objects, actions, events, or choices
4		Express personal preferences and feelings
5		Make choices from meaningful alternatives
6		Make comments and share opinions
7		Ask for and give information, including information about changes in routine and environment
8		Be informed about people and events in one's life
9		Access interventions and supports that improve communication
10		Have communication acts acknowledged and responded to even when the desired outcome cannot be realized
11		Access to functioning AAC and other AT services and devices at all times
12		Access environmental contexts, interactions, and opportunities that promote participation as full communication partners, with other people, including peers
13		Be treated with dignity and addressed with respect and courtesy

Number	PCS Symbol	The right to…
14		Be addressed directly and not be spoken for or talked about in the third person while present
15		Have clear, meaningful, and culturally and linguistically appropriate communications

Source: The Picture Communication Symbols ©1981-2015 by Mayer-Johnson LLC. All Rights Reserved Worldwide. Used with permission.
Source: The Communication Bill of Rights (Brady et al., 2016). Reprinted with permission.

Instrument

Two tasks were created for all participants to complete. The first was open-ended and the second was multiple-choice. Two were constructed because the type of task impacts results when participants are asked to demonstrate comprehension of symbols (see Wolff & Wogalter, 1998). While an open-ended format is often recommended, responses to open-ended questions can be vague (Lesch & McDevitt, 2002). Multiple-choice clarifies responses, but it also narrows the range of response options. As such, in the current study, both an open-ended and a multiple-choice format were used to ask participants what right each symbol represented.

To construct the two tasks, original versions of the graphic symbols that appeared in the AGOSCI Inc. (2017) symbol-supported version of the Communication Bill of Rights (Brady et. al., 2016) were secured from Boardmaker Online© and uploaded to Qualitrics. In both tasks, the symbols were presented in 3” x 3” size. In the open-ended task, each symbol was presented in random order with a text-entry box. A directions screen was inserted that explained that participants would see symbols representing the Communication Bill of Rights one at a time, and they were to use the space provided to write the right the symbol represented. “The right to” was written beneath each symbol and above the text entry box in order to support responses (see Figure 1, Open-ended survey question format, for example).

The second task was also constructed to present the graphic symbols in random order, but each was accompanied by a drop-down menu with all 15 rights. The directions informed participants that they should select the right they believed was represented by each symbol. The drop-down menu included all 15 rights for each graphic symbol to prevent participants from using process of elimination to make decisions.

The two tasks were combined into a single Qualtrics survey. The open-ended task always appeared first, followed by the multiple-choice task, and then a section requesting relevant demographic and prior-usage information including date of birth, gender, year in school, prior AAC course experience, and prior experience with PCS symbols. Participating students had as much time as they needed to complete the survey.

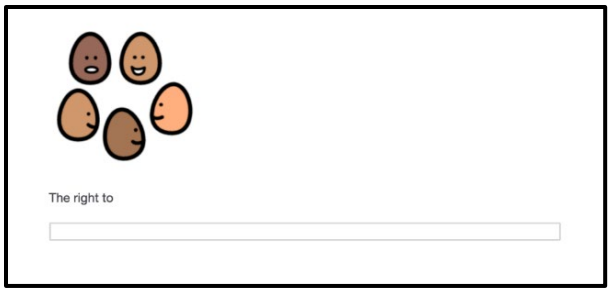

Figure 1: Open-ended survey question format.

Source: The Picture Communication Symbols ©1981-2015 by Mayer-Johnson LLC. All Rights Reserved Worldwide. Used with permission.

Procedure

Participants were recruited during a regularly scheduled meeting of the graduate course in augmentative and alternative communication that they were completing. They were given a brief overview of the study and informed about the purpose of the investigation (i.e., to further our understanding of how graphic symbols support comprehension). Students were informed that their participation was voluntary and that their individual responses would be kept confidential. Subsequently, anonymous links to the Qualtrics survey were distributed to the entire class via email. Once opened, the survey prompted participants to indicate that they consented to participate in the study. All participating students independently accessed the survey via their own personal computers by using the anonymous link sent to their academic email accounts.

Analysis

Recommendations for scoring open-ended questions about symbol meaning overwhelmingly favor a purely dichotomous procedure (Lesch & McDevitt, 2002; Wolff & Wogalter, 1998). However, this risks reducing or limiting the richness of the analysis (Lesch & McDevitt, 2002). With this in mind, a modified dichotomous scoring procedure was created. Rather than score the participants' responses as completely right (1) or completely wrong (0), the rights were broken down into meaningful components. Some rights had only two or three meaningful components while others had as many as six (see Table 2, Meaningful Component Breakdown by Right for a breakdown of the meaningful components in each right). This scoring paradigm involved giving credit for partially accurate responses, including one-word responses that reflected a major, meaningful component of the right, without losing the richness and complexity that each right represents. To ensure the reliability of the scoring, the first author scored all responses and the second author re-scored 20% of the participants' responses to all 15 rights. Overall, agreement (i.e., number of agreements divided by the total number of possible points) was 95%, with modest variations by participant (92-98%) and by right (87-100%). Disagreements were discussed with a final decision determined by consensus.

Table 2: Meaningful Component Breakdown by Right

	Component 1	**Component 2**	**Component 3**	**Component 4**	**Component 5**	**Component 6**
1	interact socially	maintain social closeness	and build relationships			
2	request	desired objects	actions	events	and people	

	Component 1	Component 2	Component 3	Component 4	Component 5	Component 6
3	refuse or reject	undesired objects	actions	events	or choices	
4	express	personal preferences	and feelings			
5	make choices	from meaningful alternatives				
6	make comments	and share opinions				
7	ask for	and give information	including about changes in routine	and environment		
8	be informed	about people	and events	in one's life		
9	to access intervention	and supports	that improve communication			
10	have communication acts acknowledged	and responded to	even when the desired outcome cannot be realized			
11	have access to functioning AAC	and other AT services and devices	at all times			
12	access environmental contexts	interactions	and opportunities	promote participation as full communication partners	with other people,	including peers
13	be treated with dignity	addressed with respect	and courtesy			
14	be addressed directly	and not be spoken for	or talked about in the third person and share opinions while present			
15	have clear	meaningful	and culturally and linguistically appropriate communication			

The multiple-choice questions were scored dichotomously, and the participants' raw scores were used for item analysis. This approach to item analysis allowed each item to be given a difficulty and discrimination index score, and it allowed for response patterns to be investigated. In this context, difficulty referred to the probability that participants correctly identified the right that matched an individual graphic symbol. Lower difficulty scores indicate that items were more difficult for a group of participants. See Table 3, Difficulty Range and Interpretation, for item difficulty ranges and interpretations.

Table 3: Difficulty Range and Interpretation

Range	Interpretation
0.0-0.3	Extremely difficult
0.3-0.5	Very difficult
0.5-0.7	Moderately difficult
0.7-0.9	Moderately easy
0.9-1.1	Very easy

Item discrimination refers to the ability of an individual item to differentiate among participants' overall performance. That is, when an item has a lower discrimination score, then participants who are good at identifying the rights that are represented by symbols are more likely to respond correctly to that item, whereas those who are poor at identifying the right that is represented by a symbol are more likely to get that item wrong. Discrimination is considered "good" if the index is above .30; "fair" if between .10 and .30 and "poor" if below .10 (Crocker & Algina, 1986).

Results

The Open-Ended Task

Participant responses to the open-ended task were analyzed to determine the number of major concepts represented for each right and the number of total words participants used to describe the right represented by each graphic symbol.

Content. Descriptive statistics regarding the number of major concepts represented were calculated for the group and for each right. Overall, most responses (58.8%) did not represent any of the meaningful components. The responses that did include a meaningful component only included one (31%) or two (10.1%) components. Frequency counts for the percent of concepts represented by the whole group across all rights are presented in Table 4, *Concepts Represented Across All Responses.*

Table 4: Concepts Represented Across All Responses

Concepts Represented	Frequency	Cumulative Responses
0%	459	58.85%
15-25%	76	68.59%
30-50%	184	92.18%
60-75%	59	99.74%
100%	2	100%

Each participant received a total score for each right. This was done by dividing the number of components represented by the total possible components. Overall, group performance was extremely low (*M* = 16.83%, 0-54.5%). Descriptive statistics for the group, as well as by year in school, are presented in Table 5, Total Score by Group and Year in School, along with results from paired-samples t-tests. While overall performance was low, significant differences between years in school were found for responses for two rights. First-year student responses were more likely to represent one component of the twelfth right, and one to two components of the ninth right.

Table 5: Total Score by Group and Year in School

Right	Group Mean	Year 1 Average	Year 2 Average	*p*-value
1	19.2%	19.2%	18.7%	1.00
2	8.8%	8.5%	9.6%	0.802
3	18.5%	20.0%	16.8%	0.356
4	54.5%	52.6%	53.3%	0.417
5	48.1%	46.2%	50.0%	0.327
6	20.2%	21.1%	20.%	1.00

Right	Group Mean	Year 1 Average	Year 2 Average	*p*-value
7	15.4%	13.5%	18.0%	0.554
8	0.0%	0.0%	0.0%	
9	25.6%	33.3%	17.3%	0.005*
10	0.6%	0.0%	1.3%	0.327
11	35.3%	33.3%	37.3%	0.502
12	2.6%	4.5%	0.7%	0.011*
13	0.0%	0.0%	0.0%	
14	3.2%	3.2%	2.7%	0.664
15	0.6%	0.6%	1.3%	0.327

Word count. Descriptive statistics regarding the number of words participants typed in response to each symbol are presented in Table 6, Word Count by Right. More than half of the responses included only one to two words (56.54%), with one- to three-word responses constituting 75% of all responses. The Communication Bill of Rights (Brady et. al., 2016) averages 10 words per right (5-18).

Table 6: Word Count by Right

Right	0-2 Words Used	Minimum	Maximum	Mean
1	38.5%	1	12	3.38
2	63.5%	1	5	2.29
3	80.8%	1	5	1.88
4	61.5%	1	9	2.63
5	78.8%	1	7	1.79
6	50%	1	6	2.38
7	46.2%	0	10	3.19
8	50%	1	11	3.37
9	42.3%	0	11	3.29
10	67.3%	1	7	2.12
11	50%	1	15	3.52
12	57.7%	1	12	2.88
13	61.5%	1	5	2.19
14	46.2%	0	7	2.67
15	53.8%	1	8	3.02
Mean	56.54%	0.73	8.67	2.71

Multiple Choice

Descriptive statistics in regard to responses to all 15 symbols are shown in Table 7, Multiple Choice Results. The symbols with high percentages of correct responses were those that referred to the right to refuse (92%), express feelings (85%), make requests (83%), and to make choices (81%).

The most poorly comprehended symbols referred to the right to be informed about people and events in one's life (0%); to have communication acts acknowledged and responded to even when the desired outcome cannot be realized (7%), and to be treated with dignity and addressed with respect and courtesy (15%). Paired-samples t-tests indicated no differences between participants performance based on year in school. Overall participants correctly matched symbols to text 48.7% of the time.

Table 7: Multiple Choice Results

Right	Participants Correct	First Years Correct	Second Years Correct	*p*-value
1	61.5%	53.8%	68%	0.340
2	82.7%	84.6%	80%	0.295
3	92.3%	96.2%	88%	0.720
4	84.6%	80.7%	88%	0.377
5	80.8%	80.7%	84%	0.295
6	42.3%	46.1%	40%	0.639
7	48.1%	53.8%	40%	0.755
8	0%	0%	0%	
9	36.5%	42.3%	32%	0.694
10	7.7%	3.8%	12%	0.720
11	71.2%	76.9%	68%	0.377
12	11.5%	7.7%	16%	0.540
13	15.4%	7.7%	24%	0.074
14	44.2%	46.2%	40%	0.877
15	51.3%	50%	52%	0.562

An item-analysis was completed to arrive at a difficulty and discrimination score for each symbol (see Table 8, Item Analysis Results). The majority of the items were moderately, very, or extremely difficult for the participants (*M* = 67%). The remaining items received difficulty indexes that are interpreted as moderately easy (27%), with only one item receiving a very easy difficulty index score. The discriminating abilities of the items were predominately fair (60%). Two items had good discrimination, and three had poor discrimination. One item did not receive a discrimination score as no participants correctly identified the right associated with that symbol.

Table 8: Item Analysis Results

Right	Difficulty	Interpretation	Discrimination	Interpretation
1	0.6154	Moderately Difficult	0.0894	Poor
2	0.8269	Moderately Easy	0.0675	Poor
3	0.9231	Very Easy	0.2879	Fair
4	0.8462	Moderately Easy	0.3770	Good
5	0.8077	Moderately Easy	0.2996	Fair
6	0.4231	Very Difficult	0.2086	Fair
7	0.4808	Very Difficult	0.1659	Fair
8	0	Extremely Difficult		
9	0.3462	Very Difficult	0.2785	Fair
10	0.0769	Extremely Difficult	0.1122	Fair
11	0.7115	Moderately Easy	0.1246	Fair
12	0.1154	Extremely Difficult	0.0335	Poor
13	0.1538	Extremely Difficult	0.1591	Fair
14	0.4423	Very Difficult	0.1798	Fair
15	0.4808	Very Difficult	0.3085	Good

Discussion

The results of this investigation provide evidence that graphic symbols, in this case, the Picture Communication Symbols© (Mayer-Johnson, 2006), provide little support for comprehending the text of

the Communication Bill of Rights (Brady et al., 2016). Regardless of year in school or previous symbol exposure, the participants demonstrated little success in either providing the content of each right when confronted with the symbol or attempting to match the symbol to the correct right. Specifically, in the open-ended condition, the participants failed to write anything related to the right over half of the time (58.8%), while in the matching condition they were correct less than half of the time (48.9%). These results suggest that the graphic symbols were not effective at supporting the participants' understanding of the Communication Bill of Rights (Brady et al., 2016).

In addressing our first question, we found that literate adults who were familiar with the purpose of the Communication Bill of Rights and with graphic symbols were unable to determine the content of each right based solely on the graphic symbol. When participants' responses included a component of the target right (41.2% of responses), an overwhelming percentage of those responses (92.18%) included 50% or less of the entire content of the right. That is, most of the time, the participants were unable to extract the meaning the symbol was intended to represent. The two correct responses (0.3% of all responses) were provided for the sixth right, The right to make comments and share opinions. It should be noted that this right was considered to only have two major components (1) to make comments and (2) share opinions, increasing the likelihood that a participant would encode the entire meaning of the text from a single graphic symbol.

An unexpected finding when examining the open-ended responses was the participant use of single-, two- and three-word phrases. As literate adults pursuing advanced degrees, it was assumed that the participants had previous experience with and exposure to the writing style of the Communication Bill of Rights (Brady et al., 2016). That is, we had anticipated that the participants would understand that rights tend to be statements that often have complex structure and syntax. When just accounting for the number of words, the Communication Bill of Rights (Brady et al., 2016) averages ten words per right, with a minimum of five and a maximum of eighteen words. Regardless of the length of each individual right, the individual graphic symbols were insufficient to elicit responses equal in length to the target.

Not only did the single symbols only elicit very brief responses in regard to length, but they also elicited very few main concepts. That is, for the open-ended responses that did pertain to the target right, a majority only represented one major concept (75.4%) with the remaining correct responses only representing two concepts (24.6%). Overall, this suggests that even for highly-literate adults, graphic symbols convey limited conceptual information. While not directly assessed, it appears that previous experience and performance with reading and writing texts like the Communication Bill of Rights were insufficient to overcome this. That is, these highly literate adults did not employ their background knowledge when responding but rather responded solely to the graphic image as a symbol representing a single, isolated meaning.

In addressing our second question, we found that the same adults demonstrated difficulty matching each graphic symbol to the appropriate right. As matching symbols is an easier task, it is not surprising that the participants were able to be highly successful on an isolated set of symbols (greater than 80%

accuracy for rights 2-5). However, taken as a whole the reduction in production burden did not appear to facilitate increased correct responses. Rather, participants were correct less than 50% of the time.

In order to measure how difficult the matching condition was, an item analysis was conducted. The results demonstrate that most of the items (67%) fell within the moderately to extremely difficult category. Only one item was determined to be extremely easy. Considering that the recommendation to pair graphic symbols with texts is based on the theory that graphic symbols make text comprehension easier, we would anticipate that item analyses would indicate far more items in the moderately to very easy category.

The item analysis also provides an index of item discrimination. Discrimination scores represent how likely it is that participants who performed well overall on a measure also performed well on a given item. If graphic symbols were helpful in aiding comprehension, it would be important to see that respondents who did well on individual items also did well on the overall measure. That is, good overall graphic symbol decoders should have done well on individual items. The majority of the discrimination scores are in the fair range, likely because of the overwhelmingly poor participant performance. This means any one symbol is equally as predictive of the participant's poor performance as the next symbol.

One argument for pairing graphic symbols with text is that it makes it easier for persons with IDD to extract meaning from text that they might not otherwise be able to read or understand (Sutherland & Isherwood, 2016). However, research has shown that consultants trained to support persons with IDD have difficulty understanding the meanings of graphic symbols (Strydom et al., 2001). The participants in the current study also had difficulty interpreting the meaning of these symbols. If adults who are likely to support persons with IDD in learning to use symbols to extract meaning find the task difficult, they are unlikely to be successful in their efforts to teach others to do so.

Limitations

This study is limited with respect to its sample composition and size, as well as the narrow focus on the single symbols paired with the Communication Bill of Rights (Brady et al., 2016). Sample composition and size were constrained by the graduate students enrolled in the augmentative and alternative communication course targeted for recruitment. Recruiting more pre-service and working professionals from a variety of disciplines (i.e., teachers, occupational therapists) who work with individuals with IDD would increase the external validity of this study, and the transferability of results to the wider population of adults who work with individuals with IDD.

Another limitation was the conscious decision to focus solely on the single symbols commonly paired with the Communication Bill of Rights (Brady et al., 2016). It is possible that participants would have been more successful in determining the critical elements of each right in the open-ended task if they had access to symbols representing each of the words or each of the key words in each right. Similarly, it is logical that more graphic symbols would have allowed participants to use a range of problem-solving skills to match a string of symbols to the appropriate right. However, our extensive search of efforts to make the Communication Bill of Rights accessible consistently revealed solutions with single symbols

representing each right rather than a string of symbols to match each word or keyword. As such, we felt it was important to investigate the supportiveness of the single symbols.

Implications and Future Research

The results of this study demonstrate that the graphic symbols paired with the Communication Bill of Rights (Brady et al., 2016) did not support participants' text comprehension, regardless of task, year in school, or previous exposure to graphic symbols. Furthermore, even for these highly literate adults, the task of matching symbols to text was difficult at best. The findings presented in this study do not support the pairing of graphic symbols with text, as it does not facilitate text comprehension. Rather, it represents a challenging task that even those with high levels of literacy and experience with graphic symbols are unable to complete successfully.

As we look towards improving the literacy outcomes for people with IDD, alternatives to symbolated text need to be investigated. For example, recommendations nearly universally support the use of shortened and simplified text (e.g. Freyhoff et al., 1998; Nomura et al., 2010). Simplifying the text in this way would be required to take advantage of text-to-speech and other common means of making text more accessible to individuals with a variety of disabilities, as individuals with IDD struggle with comprehension, whether listening to or reading text (Douglas et al., 2009). Assistive technologies that automatically simplify text should be investigated both by academics and manufacturers. These technologies might be paired with comprehensive literacy instruction to support people with IDD in increasing their literacy skills: both decoding and comprehension. Pairing instruction with assistive technologies that actually improve access to text and text-based interactions would have the benefit of increasing skills for people with IDD beyond teaching them the meaning of an individual text. Only by improving decoding, fluency, and comprehension might we support people with IDD in becoming independent readers with wide, independent access to text.

Conclusions

As policymakers continue to implore schools and school teams to improve the instruction and assistive technology supports provided to students with IDD, it is important to consider the role of graphic symbols as an assistive technology support. While there is ample evidence that graphic symbols are helpful in the context of expressive communication for individuals with complex communication needs (Beukelman & Mirenda, 2013) there continues to be little evidence that they are a useful support for text comprehension (Erickson et al., 2010). Rather than continuing with an approach that has consistently proven not to achieve its intended purpose, the field of assistive technology should direct efforts to identifying and developing technologies that improve direct access to and comprehension of text. This will have a direct impact on the text-based learning opportunities we might provide people with IDD, ultimately improving literacy outcomes in a way that pairing graphic symbols with text has failed to provide.

Declarations

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