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Field-Testing Reusable Learning Objects Related to Sensory Over-Responsiveness

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Abstract

Background. There is an increased need for dynamic, mobile, and relevant parent and caregiver education related to autism spectrum disorders (ASD) and Sensory Processing (SP). This need may be due to the increased incidence of the conditions' co-morbidity and the revision of the diagnostic criteria of ASD. Reusable learning objects (RLOs) have been implemented as instructional tools as a part of, or adjunct to, formal health care education programs. However, there is a lack of knowledge regarding the appropriateness of RLOs as a part of routine patient and caregiver instruction of children with ASD.

Method. A semi-structured interview/rating scale was implemented among three practicing occupational therapists to ascertain their opinions regarding six prototype RLOs related to sensory processing for caregivers of children with ASD.

Results. The participants' perspectives revealed that the SP-based prototype RLOs were a viable and valuable option to be included as a resource for parents and caregivers of children with ASD.

Conclusion. The findings of this study suggest that RLOs related to SP were valuable, especially related to their subject matter, accessibility, and reusability. Furthermore, the participants indirectly identified the strengths related to the foundational concepts of RLOs and how they could be applied to other therapeutic and behavioral topics for parents and caregivers of children with ASD.

Keywords

Reusable Learning Objects, Sensory Processing, Parent Training

Credentials Display

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Sensory processing has been defined as the way sensory information is managed in the cerebral cortex for meaningful interaction with the social and physical world (Baker, Lane, Angley, & Young, 2008). Pediatric occupational therapists (OTs) often treat children who carry a diagnosis of an autism spectrum disorder (ASD) with comorbid sensory processing impairments. A sensory processing impairment has been defined as a disruption in the way an individual processes sensory information that negatively disrupts self-regulation, social participation, school performance, and other functional abilities (Cohn, Miller, & Tickle-Degnen, 2000; Parham & Mailloux, 2001). The prevalence of comorbidity of ASD and sensory processing impairment has been estimated to be between 69% and 95% (Baranek, David, Poe, Stone, & Watson, 2006; Tomchek & Dunn, 2007). Experiencing sensory processing difficulties in addition to an ASD may result in additional behavioral and/or emotional problems, decreased independence with activities of daily living or instrumental activities of daily living, social engagement, and academic underachievement (Ashburner, Ziviani, & Rodger, 2008; Baker et al., 2008), all of which are areas OTs can address through appropriate and meaningful interventions.

In addition to the increased prevalence of children who have both ASD and a sensory processing impairment on OTs' caseloads, there is a trend toward family-centered care in which parents and therapists each contribute knowledge to encourage positive, effective intervention outcomes. In this approach, parents are seen as the experts on their child, family, and needs, while the OTs are seen as technical knowledge experts. Embracing both perspectives allows therapists to develop a holistic perspective of the child within his or her context (DeGrace, 2003). Levasseur (2010) and Hewitt and Hernandez (2014) state that health literacy, that is, accessing and understanding health-related information, promotes better intervention outcomes. This indicates that caregiver and/or parent education regarding the child's diagnosis and intervention approaches paired with collaboration with occupational therapy are critical to positive outcomes. Despite the best intentions of accessing health-related information to promote health literacy, the parents of children with ASD often face constraining factors of limited time and access to caregiver education. Consumers of common therapies (occupational therapy, speech language pathology, special education, etc.) face the challenge of identifying and using reliable sources of caregiver education in a time-efficient way. This pilot study examines the use of reusable learning objects as a means of partially overcoming this challenge.

Literature Review
Autism Spectrum Disorders and Sensory Processing Impairments

Sensory processing impairment and its criteria, specifically sensory hypo-reactivity (under-responsiveness) and sensory hyper-reactivity (over-responsiveness), has been added to the updated ASD diagnostic criteria in the DSM-V (American Psychiatric Association, 2013). Sensory over-responsiveness (SOR) has been defined as an

exaggerated negative reaction (emotional, behavioral, etc.) to a sensation, and may occur within one or more sensory systems, such as tactile, auditory, or vestibular (Miller, Anzalone, Lane, Cermak, & Osten, 2007). Conversely, sensory under-responsivity has been characterized as a disregard for or lack of response to sensory stimuli in an individual's environment (Miller et al., 2007).

Auditory SOR appears to be quite common among children diagnosed with ASD. In a retrospective study, Greenspan and Weider (1997) reported 100% of the 200 children with ASD presented with disturbances in auditory processing, specifically related to receptive language, and exhibited abnormal responses to auditory stimuli that impacted their daily routines. Tomchek and Dunn (2007) reported similar evidence of a relationship between auditory SOR and ASD. In that study, 50.9% of the 281 children with ASD (ages 3 to 6 years) responded negatively to unexpected loud noises, and 45.6% of the 281 children would hold their hands over their ears to protect them from sounds. The relationship of other types of SOR to ASD has also been demonstrated. Baranek et al. (2006) found that 56% of 56 children with ASD, ages 2 to 7 years, demonstrated extreme SOR to environmental sensations. Thus, there is a strong link between ASD and sensory processing impairments, and the mandate of health literacy and patient empowerment dictates that comorbid difficulties should be identified and addressed with caregivers to achieve more successful outcomes, both during therapy and during the day-to-day experiences of families.

Family Education and Training

Caregiver and parent education using multimedia techniques is an emerging means of achieving health literacy. For instance, tele-health has been successfully implemented in early intervention settings (Baharav & Reiser, 2010). Home-based, pre-recorded trainings have been used to provide information related to traumatic brain injuries, as well as to instruct caregivers about behavioral management of ASD (Nefdt, Koegel, Singer, & Gerber, 2010) and for pivotal response training for ASD (Glang, McLaughlin, & Schroeder, 2007; Gordon & Rolland Stanar, 2003). Findings of these types of studies generally demonstrated that the caregivers' and parents' increased application of knowledge improved the outcomes related to behavior in children with ASD and their families. Currently, however, there is no literature that describes the use of self-paced, online instruction, including instruction for caregivers related to ASD, sensory processing, and sensory processing impairments.

Systematic instruction related to sensory processing was conducted by Gee and Nwora (2011), and focused on caregiver training of young children with sensory processing impairments. In this study, caregivers and children attended a community-based sensory processing playgroup. Caregivers received education via presenter-led presentations on eight sensory processing concepts: sensory processing, sensory modulation, vestibular sensory processing, auditory sensory processing, tactile sensory processing, proprioception, developmental dyspraxia, and oral tactile sensory

processing. While no multimedia were used for this instruction, Gee and Nwora reported that the training increased caregivers' self-perceived understanding of sensory processing concepts, improved caregivers' ability to identify a child's sensory processing challenges, and increased caregivers' efficacy in generating and implementing sensory motor activities, such as heavy work and deep pressure. The Gee and Nwora study supports the notion that health literacy promotes better outcomes; however, the instruction was not provided in a reusable multimedia format, making it challenging for caregivers to access this information in a way that best fits their schedules or the opportunity to revisit the content. Occupational therapy professionals have a unique opportunity to become key players in the development of health literacy among our clients (Smith & Gutman, 2011). Furthermore, occupational therapy professionals have been charged to promote health and participation through the development and use of health education approaches and materials that are understandable, accessible, and usable by the full spectrum of consumers (American Occupational Therapy Association [AOTA], 2011).

Current types of instructional media related to sensory processing and sensory processing impairments available for parent and caregiver training include printed books (Bialer & Miller, 2011; Kranowitz, 2006; Miller, 2006) and non-commercial educational Internet websites. A potentially powerful tool for instruction is the reusable learning object (RLO), which provides a platform-neutral presentation format for instructional materials that is easily and universally accessible. The RLO has the potential to improve the therapists' ability to provide diverse instructional resources that can be shared with consumers based on their learning preferences and the therapists' instructional needs.

Reusable Learning Objects

RLOs are multimedia instructional tools that could make information related to sensory processing impairments experienced by individuals with ASD and their caregivers more accessible. Wiley (2002) defined learning objects as "any digital resource that can be reused to support learning" (p. 7). RLOs consist of smaller bits of information called reusable information objects (text, video, images, narration, and animation). RLOs are designed to have varying scope or size (granularity) and the ability to be sequenced with other RLOs or other instructional activities (Gee, Strickland, & Salazar, 2014). Lymn, Bath-Hextall, and Wharrad (2008) further define RLOs as discrete units of learning. This recent multimedia approach to increase access to information has been used in educational programs, such as nursing, pharmacology, and occupational therapy (Gee et al., 2014). Click here to view an RLO.

Formal instructional settings, such as nursing, pharmacy, and physician assistant professions, have reportedly been using RLOs with targeted learners due to shifts in discipline-wide curriculum practices that limit the time and exposure given to some topics (Lymn et al., 2008; Windle et al., 2011). It has been noted that "eLearning makes sense" in that it provides an

opportunity to better target learners beyond normal constraints and is accessible any time and any place (Delf, 2013).

Lymn et al. (2008) conducted a study exploring the effectiveness of pharmacology-related RLOs among 84 baccalaureate nursing students enrolled in a pharmacology prescription course. The authors reported that 90% of the respondents indicated the RLOs aided their understanding and met the objectives of the instruction. Lymn et al. further reported that when the participants had access to all of the RLOs within the course, they viewed their understanding of the content differently from when the RLOs were not available. Participant feedback regarding the RLOs showed they would reuse the RLOs in support of other instructional content, would request additional RLOs to support future courses, and expressed interest in having access to the same RLOs once they had completed their coursework and had entered the workforce (Lymn et al., 2008).

Windle et al. (2011) attempted to track the effectiveness of chemistry-related RLOs implemented among baccalaureate nursing students taking a requisite chemistry course. The authors completed a pre/post quasi-experimental design and concluded that the students who had the RLOs as part of the chemistry workshop or through a self-study course attained higher scores on the final examinations. They also reported that participants who used the RLOs valued the functional characteristics (e.g., ability to access independent of time or location and working at their own speed)

over the media components (audio, video, image, and text).

It is evident that professional education sectors have been successfully developing and implementing RLOs as a part of formal instruction and yielding positive results (Lymn et al., 2008; Windle et al., 2011). Yet, there is a significant gap in the literature exploring the use and effectiveness of RLOs in patient and caregiver education, particularly on the topics of ASD, sensory processing, and ASD with sensory processing impairments. Therefore, the purpose of this pilot study was to conduct a field test of a series of RLOs related to tactile and auditory SOR created for parents and caregivers of children with ASD. Specifically, we sought to ascertain OTs' perceptions of the feasibility of the RLOs for parent and caregiver consumption as a part of routine occupational therapy plans of care.

Method

Design

A concurrent mixed method design was used for this pilot study (Portney & Watkins, 2009). The participants were asked to rate their perceptions of the interface, the multimedia, and the content used as a part of the RLOs. They also provided their opinions regarding their experiences interacting with the RLOs.

The Human Subjects Committee at Idaho State University approved the field test. Before beginning participation, potential participants reviewed participation protocols with the principal investigator. The principal investigator ensured that the inclusion criteria were met before individuals

were selected to participate. Participants were recruited via purposeful sampling. The principal investigators emailed fliers regarding the field test to OTs employed at regional clinics, schools, and agencies that provided skilled occupational therapy services to children with an ASD.

The participants were required to meet the following criteria: (a) licensed as an OT for a minimum of twelve months; (b) provide occupational therapy services to children with an ASD who also demonstrated SOR to at least auditory and/or tactile sensations; (c) have access to a computer with a keyboard, mouse, or other input devices; (d) have access to the Internet in order to access the RLOs; and (e) be willing to participate in an interview/survey after reviewing the RLOs.

Description of the Participants

Based on the inclusion criteria and recruitment efforts, a total of three participants began and completed the field test (see Table 1).

Table 1

Participant Demographics

Participant	Years of Experience	Type of Employment	% of Caseload is ASD	Gender
A	2 years	Full Time	50-60%	Female
B	4 years	Full Time	40%	Female
C	3 years	Full Time	50%	Female

Instructional Content

Six RLOs related to sensory processing, sensory processing difficulties, and problem solving were developed (see Table 2). The RLOs titled "Introduction to Sensory Processing," "Sensory Processing Difficulties," and "Proprioception" were designed to provide the groundwork for understanding subsequent issues specific to children with sensory processing difficulties. The RLOs titled "Tactile Sensory Over-Responsiveness" and "Auditory Sensory Over-Responsiveness" presented information regarding over-responsiveness in these two modalities. Finally, the RLO titled "A SECRET" focused on the problem-solving framework developed by Bialer and Miller (2011) that parents and caregivers can use with their children in a variety of situations (e.g., mealtimes, bedtime routines, grocery shopping). Each RLO consisted of text, images, video, and voice narration. The images and video clips imbedded in the RLOs represented examples of sensory processing or sensory processing impairments. The RLOs were hosted on SlideRocket™ with an access link embedded in the Idaho State University Community Moodle learning management system (LMS). Each RLO was designed to have content that would be reused by the same learner in the same sessions or future sessions.

Table 2

Targeted Reusable Learning Objects

RLO	Title
RLO 1	Introduction to Sensory Processing
RLO 2	Sensory Processing Difficulties
RLO 3	Proprioception
RLO 4	Tactile Sensory Over-Responsiveness
RLO 5	Auditory Sensory Over-Responsiveness
RLO 6	A SECRET

Instruments

A semi-structured interview guide was developed by Gee and Strickland (2013) for this pilot study, which included rating scales in addition to open-ended questions (see Appendix). The interview guide included three rating scales related to difficulty of the content, level of importance of the content, and quality of the instructional elements.

Procedures

The participants' responses and perceptions of the RLOs were measured using a semi-structured interview format partially based upon an RLO and course deconstruction tool (Strickland, 2012). The semi-structured interview focused on the content of the RLOs as they related to the feasibility of their use with parents and caregivers of children with an ASD and sensory processing disorder (SPD).

The participants were instructed to view the same instructional set of six RLOs that caregivers would potentially view. Specifically, they were allowed to view and/or review each RLO for as long as they wanted or for as many times as they needed. The review of content may have been an entire RLO or segments within an RLO (e.g., specific video footage and/or cases). However, the

participants would view these RLOs from the perspective of one who regularly used and disseminated sensory processing-related information in order to determine accuracy, interface design, and delivery mechanism appropriateness for the intended end-user, i.e., the parent and/or caregiver.

Following the semi-structured interview guide, the participants provided ratings regarding the level of importance of each RLO for relevance to caregivers, comfort with RLO elements, and perceived difficulty for caregivers to understand the content of the RLO. The participants were also asked to describe their own perceptions with regard to their interaction with the format, previous exposure to information presented in a similar format, and recommendations regarding RLO use with caregivers as well as suggested modifications of the RLOs.

The data generated from the interviews were then analyzed following the procedures recommended by Corbin and Strauss (2007). Each of the three interviews was transcribed verbatim to prepare for the analysis process. Once transcription was completed, coding was completed as follows: The two members of the research team separately coded each transcript, and individual coding was followed by collaborative coding reconciliation. Collaborative coding reconciliation was based on agreement of codes and their definitions with discussion between the principal investigators as necessary to resolve disagreements. In order to resolve disagreements, each coder reflected on his or her own individual assumptions, reflected on the

context of the participants' statements, clarified the definition and scope of codes, and merged coded vignettes to gain context and depth of a selected statement. After discussing and reconciling codes for the first transcript, the principal investigators coded the remaining transcripts similarly. As coding continued through the remaining transcripts and novel codes emerged, earlier transcripts were revisited to ensure appropriate codes were considered for all transcripts. This process also consisted of collaborative reconciliation. Both coders of the research team agreed on all codes and supporting statements.

Results

All RLOs were viewed at least one time by each of the three participants. Only the first two RLOs, "Introduction to Sensory Processing" and "Sensory Processing Difficulties," were viewed more than once by at least one participant (see Table 3). The average viewing time spent by a participant for all six RLOs totaled 73 minutes and 33 seconds. This is of importance because the learner(s) may have repeated content, video, or audio multiple times in the same session or in different sessions. The results will be discussed in terms of level of difficulty, level of importance, and interface utility. Coded narrative comments are then discussed.

Table 3

RLO Viewing Frequency

RLO	Number of Views	Average View Time
Introduction to Sensory Processing	6	14:15
Sensory Processing Difficulties	4	6:06
Proprioception	3	14:02
Tactile Sensory Over-Responsiveness	3	14:28
Auditory Sensory Over-Responsiveness	3	11:47
A SECRET	3	12:55

Level of Difficulty

The participants consistently ranked the "Introduction to Sensory Processing" and "Proprioception" RLOs as the most difficult for caregivers to understand (see Table 4). The participants suggested that the "Introduction to Sensory Processing" RLO consisted of processing a significant amount of new content that could be overwhelming, while the "Proprioception" RLO was deemed more academic-based with terminology and concepts that may be difficult to understand.

Table 4

Level of Difficulty of RLOs as Rated by Participants

RLO Topic	Subject Matter Difficulty (rated most difficult)
Introduction to Sensory Processing	A, B 1st
Sensory Processing Difficulties	
Proprioception	C, B 2nd
Tactile Sensory Over-Responsiveness	
Auditory Sensory Over-Responsiveness	
A SECRET	

Note. Level of difficulty (A = participant A; B 1st & B 2nd = participant B [selected two different choices]; C = participant C).

Level of Importance

When the participants were asked to rate the level of importance (e.g., relevancy) of information for caregivers of children with ASD and SPD, the participants' ratings were often based on perceptions of an RLO's foundational information versus client-specific information (see Table 5). All of the participants rated the RLOs titled "Introduction to Sensory Processing," "Sensory Processing Difficulty," and "A SECRET" as high level of importance. The main reason given by the participants for the high rating of "Introduction to Sensory Processing" was that it was considered foundational, while reasons given for the other two modules were that they provided useful examples to help understand why a child with ASD and SPD may act in certain ways and discussed how to

intervene or problem-solve through a challenging situation.

The "Tactile Sensory Over-Responsiveness" RLO level of importance ratings were split with one rating each of low, medium, and high. These ratings appeared to vary based on the types of sensory processing issues typically on a participant's caseload. Similar reasons were given for the mix of low and medium ratings on "Auditory Sensory Over-Responsiveness." The influencing factor of caseload type (e.g., treating more children with auditory sensory difficulties than those with tactile sensory difficulties) appeared to result in a medium rating for the "Proprioception" module. However, both medium and high ratings were substantiated with the point that proprioceptive activities impact behavioral organization and can be utilized for intervention in a number of ways.

Table 5

Level of Importance of RLOs as Rated by the Participants

RLO Topic	Low = 1	Medium = 2	High = 3
Introduction to Sensory Processing			A, B, C
Sensory Processing Difficulties			A, B, C
Proprioception		A	B, C
Tactile Sensory Over-Responsiveness	A	B	C
Auditory Sensory Over-Responsiveness	A	B, C	
A SECRET			A, B, C

Note. Level of importance (A = participant A; B = participant B; C = participant C).

Interface Ratings

These ratings related to comfort level with various elements of the RLOs (see Table 6). The participants were asked to rate the following: placement of pictures, placement of video, controls for the video, quality of narration, ease of navigation, amount of onscreen text, and sequencing of content within the module. Ratings were high for placement of video, quality of narration, and amount of onscreen text among all of the participants. Reasons given by the participants for the high rating on "placement of video" were that the videos were helpful and provided good examples to help viewers learn content. The quality of narration received a high rating due to its pacing, flow, and quality. The rationale given by the participants for a high rating on amount of onscreen text was simply stated as being "just right."

Table 6

Comfort Level of RLO Elements as Rated by the Participants

Interface Characteristic	Low	Medium	High
Placement of pictures		C	A, B
Placement of video			A, B, C
Controls for the video	A	B	C
Quality of narration			A, B, C
Ease of navigation	A	C	B
Amount of onscreen text			A, B, C
Sequencing of content within module		B, C	A

Note. Interface characteristics (A = participant A; B = participant B; C = participant C).

The participants' ratings of the interface were split between high and medium for placement of pictures and sequencing of content within the module. The participants who rated the placement of pictures as high believed the pictures helped reinforce the content being delivered, while the participant who gave the medium rating wanted the pictures to be more directly applicable to

intervention. The participants who gave the sequencing medium ratings shared that they thought the six RLOs could be daunting when seen altogether and should be made more informal.

Ratings were split for controls for the video and ease of navigation with one rating each of low, medium, and high. Low to medium ratings for these elements were generally related to quirks in the SlideRocket™ or Community Moodle LMS, such as not being able to pause or rewind the RLOs, while high ratings were generally substantiated with a claim that these aspects were "easy."

Narrative Findings

The qualitative analysis completed via collaborative coding resulted in seven main category codes, four of which had subcategory codes, for a total of 15 codes altogether (see Table 7).

Table 7

Coding Categories

Category Code	Subcategory Code	Key	Interpretation
1. Cognitive load	Content	CL: C	Negative
	Time	CL: T	Negative
	Modality	CL: M	Positive & Negative
2. Accessibility	Navigation	Acc: N	Negative
	Learning styles	Acc: LS	Positive & Negative
	Content	Acc: C	Positive & Negative
	Instructional tone	Acc: IT	Negative
3. Instructional sequence		IS	Positive & Negative
4. Instructional purpose		IP	Negative
5. Reusability	Not dependent to time or place	R: ND	Positive
	Customizability	R: C	Positive & Negative
6. Application	Usefulness of content to caregiver	App: U	Positive
	Lack of opportunity to facilitate transfer of learning	App: LoO	Negative
	Optimal use	App: OU	Positive & Negative
7. Expectations		E	Positive & Negative

Overall, there were 59 coded examples (see Figure 1). The "Application" category, with its three subcategories, had the highest frequency among the seven categories at 23 coding examples.

Individually, "Instructional Sequence" and "Application: Usefulness of Content to Caregiver" had the most coding examples (each had 10).
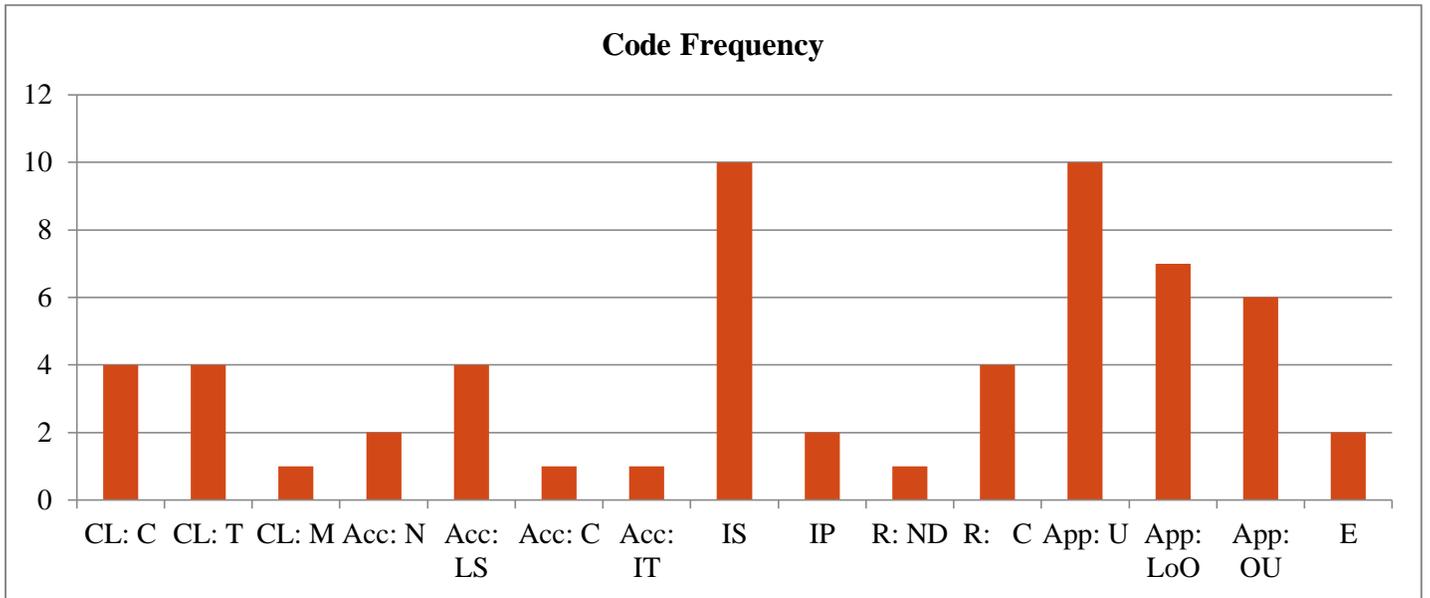
Code Frequency

Figure 1. Code Frequencies

The data was also coded to examine how the participants viewed the instruction as being positive (21), neutral (6), or negative (16) based on the statements made by each participant regarding the RLOs (see Figure 2). The findings related to interpretation frequency were then used to generate recommendations to improve the RLOs for future use among caregivers with children who experience SOR (see Discussion).
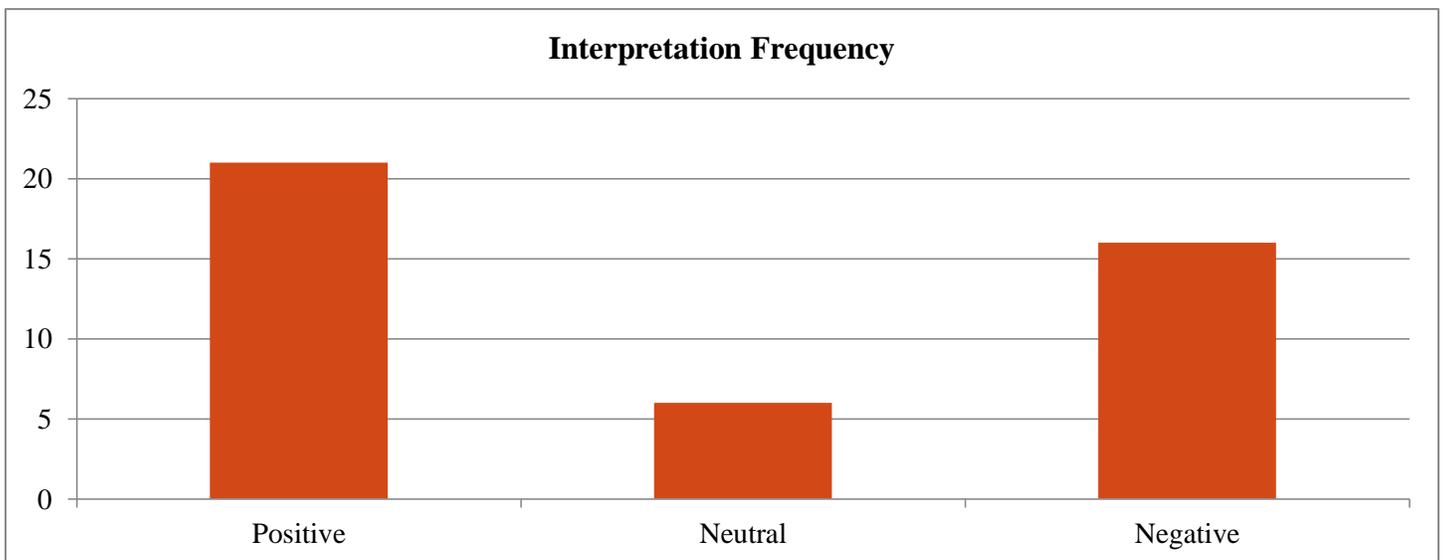
Interpretation Frequency

Figure 2. Interpretation Frequency

In order to better explain the results of the qualitative analysis, several participant quotes have been provided to help exemplify the codes.

Cognitive Load: Content (CL: C)

> But again, more modules would be better, just [be]cause there's a lot of information. So once I got to, like, sensory modulation, I almost felt like, overwhelmed by what I had just learned. (Participant B)

Cognitive Load: Time (CL: T)

> 'Cause I thought all of it was very relevant, and I don't know that I would want to exclude any of it. But it didn't seem like the timeframe allotted allowed me to read and to really listen to her. (Participant A)

Accessibility: Learning Styles (Acc: LS)

> I really liked the videos, and I liked the table down at the bottom. And maybe it's just that I'm more visual, so that was helpful for me. I understood things a lot better once I saw those. (Participant B)

Instructional Sequence (IS)

> I think it was really good to start out with the nervous system. And kind of give them an idea of what you're working with, and then to, I like that you're going into sensory processing. I think I like the flow of it. (Participant B)

Reusability: Customizability (R: C)

All eight of them covered would be beneficial. And like you said, going into wanting this to be an overall one you pick the areas where they're problematic or struggling, and I think that would probably be the next step. (Participant A)

Application: Usefulness of Content to Caregiver (App: U)

> Interviewer: "Do you feel like it's valuable for caregivers to view this information?"
> Oh absolutely. It's good because it kind of sets the foundation, so this is what we're talking about, we're talking about sensory processing in general. And then we're talking the mechanisms; we're talking about where kids might have difficulty. I think one thing that really kept standing out was that the child is not doing this on purpose and I think that that is really key for parents to know, is that the child isn't doing this deliberately. (Participant B)

Application: Lack of Opportunity to Facilitate Transfer of Learning (App: OU)

> If they were already able to change the environment, or add sensory tools for calming, or change the activity, they wouldn't need me. But usually by the time I get there they're like, 'Please do something!' So that's why I say I don't think

even reading that information that they'd be able to utilize that table for discussion to the extent that it could be. 'Cause I feel like it could just be such a great tool but I just don't know that they could get there on their own without having the concrete examples throughout. (Participant C)

Application: Optimal Use

I think I might want to do one module and then discuss it with them, and just say, 'Do you have any questions or any concerns? What'd you take away from it? How would you apply it?' So I think in small doses I would recommend it. (Participant B)

Discussion

Overall, the participants had a positive outlook on the feasibility of the use of RLOs with caregivers. The participants' ratings revealed generally high levels of importance for RLOs, and individual comments supported application of RLO use and learning. These supportive ratings and comments were often supplemented with statements regarding contingency of use upon client characteristics (e.g., a child has auditory SOR but not tactile SOR), and these qualifying comments, in reality, reinforce the use of the RLO, since the very granular nature of the RLO allows a "menu-based" approach to their use. The results of this pilot study are similar to those of Windle et al. (2011) in that the reusability components for the RLOs were

generally positive, and overall the participants would recommend them, whether or not they enjoyed the multimedia aspects as they were.

The six RLOs presented for this field test are not a comprehensive set of all possible sensory-related topics that may be needed to meet the needs of a variety of clients. To some extent, the participants were able to identify that these six RLOs were customizable in that an OT could tailor the use of specific RLOs to meet the needs of an individual client, targeting concerns that are specific to him or her and leaving out other RLOs that did not apply. The participants described optimal use of the RLOs as being a supplemental tool; the caregiver would review the RLO, then discuss its content and application with the OT.

Participant comments were particularly revealing in that they described, without prompting, the essential nature of RLOs: RLOs have granularity (can be reorganized or selected based on specific content needs) and are readily accessible. The participants brought these very concepts to the fore as they discussed the potential utility of the RLOs and their use in specific practice settings. Certain sentiments expressed by the participants reflect characteristics of RLOs, including combinability, granularity (size and scope), and accessibility (Gee et al., 2014). In particular, the participants identified the combinability of RLOs when they expressed that they would use the RLOs as supplements during routine occupational therapy treatment. They were able to identify the levels of granularity within the RLO set, in that some RLOs were more foundational (i.e., "Sensory Processing"

and "Sensory Processing Difficulties"), but that not all RLOs would be necessary to use for a particular client because the content was too specific about a particular sensory system. The participants indicated that the RLOs would potentially increase the convenience for caregivers since they could access the RLOs on their own time and through a medium (i.e., Internet) that would be easier to keep track of rather than paper-based caregiver education/training.

Of interest, some of the participants emphasized that RLO use was contingent upon the client, without realizing that this set of RLOs is not a comprehensive repository; that is, the set of six RLOs was not created to encompass all possible RLOs from which a parent or caregiver of a child with ASD may benefit. This reveals an entrancing element of RLOs themselves: Practitioners recognized the utility of the tool and began envisioning additional RLOs to meet their needs. Additionally, most of the participants did not view the majority of the RLOs more than once. It is possible that this occurred because the participants are subject matter experts on sensory processing and SPDs compared to caregivers. This may impact the participants' perceptions of feasibility of use with caregivers because caregivers would most likely reuse/review the RLOs more times than the participants did.

Recommendations for Future RLO Development

Though this was a pilot study, the participants desired to have more RLOs exploring more aspects of sensory processing and sensory processing disturbances. The topics are complex

and collaboration between instructional design experts and subject matter experts is warranted to develop RLOs that meet the needs of therapists, parents, and caregivers.

Within the RLOs, it is recommended to introduce visuals early and consistently throughout the instruction to support the complexity of the content of sensory processing. RLOs for parent and caregiver-focused instruction would be best suited to occur as a supplement or preparatory to face-to-face individualized instruction based upon each child's specific sensory processing needs. Thus, designing and developing them as a resource that could be used as a supplement and a core of sensory processing instruction is desired.

Limitations

Limitations for this pilot study are related to the interaction between the participants and the sensory-based RLOs. It is possible that attitudes regarding online learning may have biased the participants for or against the feasibility of RLO use for caregivers. The participants were asked to share their previous experience with online learning, but attitudes toward these experiences were not explored. Additionally, as noted earlier, the participants did not reuse the RLOs multiple times, with "Introduction to Sensory Processing" being the only RLO viewed an average of two times per participant. It is possible that this single-view use of the RLOs influenced the participants' perception of applicability and feasibility of use for caregivers. RLOs are designed to be reused; based on the limited number of views, it seems that the participants may not have appreciated this

characteristic of reusability inherent in RLO function and design. The OT participants were viewing the RLOs as experts who are confident with the content rather than as consumers, and therefore may have felt that it was unnecessary or redundant to view an RLO more than once. A significant limitation regarding the participant mindset in relation to RLOs is that more complex multimedia-based caregiver education/training may be perceived as threatening. OTs identify themselves as key orchestrators of the intervention process, and RLO use may be viewed as interfering with this important role. We did not have the opportunity to explore whether this possibility may have impacted the participants' ratings.

Further limitations include the small sample size; however, because this was a field test we were not attempting to reach a point of saturation. Two of the three participants have a previous relationship with the interviewer (one of the principal investigators). According to the Hawthorne effect, it is possible that this connection may have influenced the participants' responses. The semi-structured interview format, being a mix of closed- and open-ended questions, contributes to subjective answers and perspectives. Finally, since both investigators and participants are in the occupational therapy field, there is an assumed understanding regarding the RLO topics and general occupational therapy experiences that may impact the feasibility of use with caregivers who do not have the same exposure to these topics.

Recommendations for Future Research

Further field-testing needs to be conducted with potential consumers of RLOs related to sensory processing, e.g., caregivers of children with ASD who experience sensory processing impairments. Moreover, evaluating the effectiveness of RLOs in increasing the knowledge of sensory processing in caregivers, as well as the application of certain strategies to address challenging behaviors (e.g., A SECRET, a caregiver-based reasoning approach), will be of paramount importance in the future.

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Appendix
Semi-structured Interview Guide

RLO Semi-Structured Interview with Occupational Therapist
Gee and Strickland, (2013)

First, let me thank you for your participation in this important research. As an Occupational Therapist with clients who are highly functioning children with autism, you are faced with challenges in meeting their needs, and particularly the needs of their caregivers. Now that you have reviewed the content in the tutorial from the perspective of the professional Occupational Therapist, I would like to ask your insight and guidance for refining this material. To gather consistent feedback, I will ask each of the following questions as prompts as they are written. I will be happy to expand on any of the questions and may ask for additional responses.

1. There were six areas within the module you just completed. Please tell me which of these you perceive to be the most difficult to understand for caregivers.

   ☐ Sensory Processing   ☐ Sensory Processing Difficulties
   ☐ Proprioception   ☐ Tactile Sensory Over-Responsiveness
   ☐ Auditory Sensory Over-Responsiveness   ☐ A SECRET

   Follow/up & Notes:

2. In relation to the content, I would like to ask you about the relevance to caregivers of children with ASD with sensory processing difficulties. Please rate each of the following in its level of importance. I will prompt you by asking if the item is Low, Medium, or High in its importance to you as an Occupational Therapist in helping to educate caregivers of your clients.

Item	Low	Medium	High
1. Sensory Processing			
2. Sensory Processing Difficulties			
3. Tactile (touch) Sensory Over-Responsiveness			
4. Auditory (hearing/sound) Sensory Over-Responsiveness			
5. Proprioception			
6. A SECRET			

   Follow/up & Notes:

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The next several questions relate to your interaction with the format for the tutorial materials. Since this is an online or computer-driven tutorial, it is important for the researcher to gauge your perceptions related to this type of interface for the caregivers of your clients.

3. Is this your first experience with a unit of learning that is designed for online delivery?

☐ Yes ☐ No

> If Yes, can you describe your previous experience(s) with online learning?

For the following items, please rate your level of comfort with the various elements on the screen display:

Item	Low	Medium	High
1. Placement of still images (pictures)			
2. Placement of video			
3. Controls for the video (Start, Pause, Slider)			
4. Quality of the narration in the video			
5. Ease of Navigation			
6. Amount of text-based information on each screen			
7. Sequencing of content within the module			

> Follow/up & Notes:

4. Would you consider this tutorial valuable as a review for the caregiver in relation to directing his or her child's daily behavior?

☐ Yes ☐ No

> Follow/up & Notes:

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5. Would you recommend this tutorial to your caregivers of high functioning children with Autism Spectrum Disorders?

☐ Yes ☐ No

Follow/up & Notes:

6. Would you recommend that this tutorial be made available to your client caregivers?

☐ Yes ☐ No

Follow/up & Notes:

7. What changes would you recommend to the researcher for this tutorial to be a better aid to caregivers of children with Autism Spectrum Disorders?

8. What changes would you recommend to the researcher for this tutorial to be a better aid to you, as the Occupational Therapist, working with caregivers of children with Autism Spectrum Disorders?