

Experimental Evaluation of the Impact of Lived Experience and Personal Story on Neuroscience Knowledge Translation Effectiveness: Sharing the Neuroscience of ADHD with Pre-Service Teachers

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ABSTRACT— Previous work suggested that sharing personal stories is effective for knowledge translation (KT) of the neuroscience of attention deficit hyperactivity disorder (ADHD) for a teacher audience. In the current study, we experimentally evaluated the impact of personal story and lived experience on a similar KT activity. We measured knowledge and attitudes about ADHD before and after our KT activity and used a factorial design to evaluate the impact of personal story (personalized versus depersonalized) and lived experience (presenter with versus without an ADHD diagnosis) with $N = 14$ to 24 per group. The presenter without an ADHD diagnosis was a neuroscience expert. All conditions were associated with increased attribution of ADHD symptoms to the brain. Speaker quality ratings were high, especially in the personalized + ADHD diagnosis condition and the depersonalized + no ADHD diagnosis condition. While incorporating lived experience

is important for authentic KT, we demonstrated that the KT presenter themselves need not have lived experience to change pre-service teacher attitudes and beliefs. More work is needed to address the potential impacts of neuroscience expertise and other aspects of the presenters in our study.

Responding to recent calls for more teacher education in neuroscience (e.g., Dubinsky et al., 2019; Dubinsky, Roehrig, & Varma, 2022; Jolles & Jolles, 2021; Privitera, 2021), work has begun to adapt knowledge translation (KT) strategies to the context of education (Isenor, Mazerolle, & Barker, 2021). Most often considered in healthcare contexts, KT can be defined as activities that are designed to effect some change in attitudes, behaviors, or understanding in the target audience (Davis et al., 2003; Grimshaw, Eccles, Lavis, Hill, & Squires, 2012).

One potential application of neuroscience KT for educators relates to neurodiversity and neurodivergent students. The term neurodiversity was first coined by Judy Singer in the 1990s in relation to Autism. Singer has lived experience with Autism and the term she coined reflects multiple facets of Autism that were previously unnamed and under-considered. For example, the term acknowledges the

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limitations of a linear spectrum for describing Autistic people (Singer, 2017), and further highlights the failures of the medical model for understanding Autism (e.g., Baron-Cohen, 2017). More recently, the term neurodiversity is often used more generally to reflect that brain-based differences exist among all individuals, are wide-ranging, and deserve respect and consideration within a strengths-based paradigm (e.g., Armstrong, 2012). Likewise, the term neurodivergence, first used by Autistic advocate Kassiane Asasumasu, refers specifically to brain functions that are significantly outside the typical range (Asasumasu, 2016). There is by no means consensus on how to use these terms. Given that it can be argued that we all contribute to neurodiversity, we opt to use the term neurodivergence to connote the strengths and challenges associated with neurodevelopmental disorders such as attention deficit hyperactivity disorder (ADHD).

In addition to brain differences (see below for more neuroscience details), ADHD is associated with negative academic impacts for many children. As a result, the impact of teachers on students with ADHD has been well-investigated. Teachers can have a major role in both creating and ameliorating barriers for students with ADHD. With regards to creating barriers, multiple studies have reported stigmatizing behavior from teachers, teachers failing to agree on a plan for positive change with families, teachers attributing symptoms to student or family characteristics rather than school contexts, and/or teachers setting arbitrary boundaries for acceptable and unacceptable behavior (Gwernan-Jones et al., 2016). Many classroom-based interventions have been investigated in an effort to reduce these barriers, often with researchers serving as the interventionist. Many interventions have been found to be at least somewhat effective; however, the interventions are not always designed with teachers in mind, and are commonly criticized for not being feasible for teachers to carry out (e.g., Harrison, Soares, Rudzinski, & Johnson, 2019).

A previously developed KT intervention on the neuroscience of ADHD for an audience of pre- and in-service teachers (Isenor et al., 2021) sought to use neuroscience education as a means to reduce ambivalence towards ADHD among teachers (Boon, 2020) and improve the relationship between teachers and their students with ADHD (Ewe, 2019). There is a large body of evidence from neuroscience, particularly brain imaging, that the brains of individuals with ADHD are different from neurotypical controls (e.g., Cortese et al., 2012; Kasperek, Theiner, & Filova, 2015; Samea et al., 2019; Shaw et al., 2007). In recent years, there has been a marked increase in adults seeking diagnosis and treatment of this condition (Abdelnour, Jansen, & Gold, 2022; Chung et al., 2019), suggesting that symptoms of ADHD may be missed by teachers, parents, and physicians in early years in mild or nonstandard

presentations (Sibley, 2021), particularly in women and girls (Hinshaw, Nguyen, O'Grady, & Rosenthal, 2022). This further motivates increased teacher training related to ADHD.

Drawing on previous work highlighting the potential value of storytelling in KT (Bourbonnais & Michaud, 2018), Isenor et al. (2021) incorporated the lived experience of an individual with ADHD into their KT activity. A member of the research team shared their experiences of having an ADHD diagnosis as a means to connect with the audience and contextualize the neuroscience content (Isenor et al., 2021). The individual with lived experience also facilitated the workshop. While results suggested that the intervention was effective, it was not possible to determine how the lived experience or the personal story components impacted KT's effectiveness. Further, it would be difficult to scale up interventions that require a person with lived experience to deliver the KT. Likewise, it would also be difficult to adapt this approach to other neurodevelopmental conditions for which an individual with lived experience may not wish to facilitate workshops.

In the current study, we used an experimental design to evaluate the impact of personal story on the effectiveness of a KT activity designed to share the neuroscience of ADHD with pre-service teachers. We further evaluated whether having a presenter with an ADHD diagnosis was more effective than a presenter without an ADHD diagnosis. This design allowed us to explore the impact of lived experience and personal story on KT's effectiveness.

METHODS

Ethics Approval and Informed Consent

We received approval from our institutional research ethics committee, which adheres to the Tri-Council Policy Statement for the Ethical Conduct of Research Involving Humans. Informed consent was obtained from all research participants prior to participation.

Participants

Pre-service teachers from the Bachelor of Education (BE) program at our institution were invited to one of four workshops on the neuroscience of ADHD. Workshop attendees also had the option of participating in the research study. Attendees were offered a certificate for their professional development dossiers (independent of research participation). In the personalized condition, 24 participants were assigned to the presenter with lived experience and 22 were assigned to the presenter without lived experience. In the depersonalized condition, 14 participants were assigned to the presenter with lived experience, and 15 were assigned to the presenter without lived experience.

KT Activity and Experimental Design

We adapted the KT activity used in a previous study (Isenor et al., 2021). Briefly, the KT activity format included a lecture with slides as well as interactive components such as a word cloud and small group discussion. The material included a number of neuroscience-related topics relevant to ADHD (e.g., the brain basis of executive function, and brain differences in children with ADHD versus typically developing children). We also challenged myths surrounding ADHD, presented strengths associated with ADHD, and introduced the concept of neurodiversity. The material was contextualized based on the lived experience of one of the members of the research team who shared personal stories of her education and ADHD diagnosis.

We used a factorial design with three factors: time (before versus after the KT activity), content (personalized versus depersonalized), and presenter (with versus without an ADHD diagnosis). In the personalized condition, the KT activity included specific details and stories about the person whose lived experience was used to create the activity. For example, the presenter shared photos of themselves, their own academic transcripts before and after diagnosis, and memories such as loving school until it was not sufficiently challenging, and challenges they experienced specific to being a girl with ADHD in a rural school context. In the depersonalized condition, the content was similar but presented without reference to a specific person. For example, the slide show included stock photographs, and general information about symptoms, diagnosis, and impact on academic performance. With regards to the presenter factor, the presenter with the ADHD diagnosis was the person whose lived experience was incorporated into the KT activity, and was a recent honors psychology graduate. The presenter without an ADHD diagnosis was the neuroscience expert who contributed to the KT activity.

Procedure

On each day we hosted workshops, two KT activities were run simultaneously: one was led by the presenter with ADHD, and one was led by the presenter without ADHD. On the first day, both presenters covered the personalized content. On the second day (approximately 1 month later), both presenters covered the depersonalized content. Each attendee took part in only one workshop.

Attendees were invited to participate in the research. Before the workshop began, a QR code was displayed to allow attendees to access the pre-activity survey using their mobile phones. Paper surveys were also available. The survey included questions on whether the participant was in the first or second year of the BEd program, and whether they were in the primary or secondary school BEd program. For participants in the secondary program, we also asked what their teachable subjects were.

To assess pre-workshop knowledge, beliefs, and attitudes, we used a combination of open-text and rating scale questions (all using a seven-point scale). An open-text question asked participants to share their experiences and beliefs about ADHD. To assess attitudes about ADHD, we adapted questions from Lebowitz, Rosenthal, and Ahn (2012). These questions ask participants to consider a student with an ADHD diagnosis. Participants are then asked to rate the role of willpower in controlling symptoms and school performance, and whether students with ADHD should be punished for distracting other students. We also asked participants to rate the degree to which ADHD symptoms are attributable to the brain, and the degree to which ADHD symptoms are attributable to social factors such as parental discipline. Finally, an open-text question asked whether the participants were aware of any strategies to support students with ADHD.

After the KT activity, another QR code was displayed. Paper post-activity surveys were also available. To assess changes after participating in the workshop, the post-activity survey also included the questions adapted from Lebowitz et al. (2012) and the questions asking participants to rate the degree to which ADHD symptoms are attributable to the brain, and the degree to which ADHD symptoms are attributable to social factors. In addition, the post-activity survey asked participants to rate how much the personal story helped contextualize the neuroscience, the quality of the information, and the quality of the speaker (seven-point scales). Additional open-text questions in the post-activity survey asked about how the neuroscience of ADHD and how stories from individuals with ADHD will inform their teaching practice. We also asked about major takeaways and for feedback on the workshop, using open-text questions.

Data Analysis

SPSS 27 was used to analyze the rating scale survey questions. Mixed ANOVAs with one within-participants factor (time: before and after participating in the KT activity) and two between-participants factors (presenter: with and without ADHD diagnosis; content: personalized and depersonalized) were used for questions asked both before and after the activity. For questions asked only on the post-activity survey, a multivariate between-participants 2 * 2 ANOVA (content * presenter) was performed.

Open-ended text questions were analyzed using qualitative description (Sandelowski, 2000) with NVivo 12 (QSR International Pty Ltd., 2018). Initial codes and themes were developed with student researchers as led by the first author, and subsequently validated in collaboration with the senior author. Disagreements in coding were negotiated, and re-coded with consensus between the lead and senior authors.

Table 1
Ratings Before and After the Knowledge Translation (KT) Activity

Question	Ratings (averaged across groups and conditions)				p (pre- vs. post-activity)	N
	Pre-activity		Post-activity			
	M	SE	M	SE		
Suppose the student receives the treatment that is standard for ADHD but does not improve. To what extent is this due to the student's lack of self-discipline or willpower?	1.63	0.13	1.14	0.09	<.001	59
Suppose the student is failing in school. To what extent is this due to their lack of self-discipline or willpower?	1.47	0.10	1.19	0.09	.011	59
Suppose that other children who sit near the student in class are distracted by their behavior, which negatively impacts their learning. To what extent should that student be reprimanded or punished?	1.46	0.10	1.21	0.08	.023	59
To what degree do you attribute ADHD symptoms to social factors (e.g., parental discipline)?	2.63	0.21	1.99	0.19	.017	58
To what degree do you attribute ADHD symptoms to the brain?	5.43	0.23	6.68	0.14	<.001	58

Note. Participants were asked to consider a student with an ADHD diagnosis and to provide a rating out of seven in response to each question. A rating of one corresponded to “Not at all” and a rating of seven corresponded to “Completely.” SE refers to standard error.

RESULTS

Participant Characteristics

We had 112 registrants for the workshops, and a total of 75 participants fully or partially completed the surveys. In the personalized condition, 24 participants were assigned to the presenter with lived experience and 22 were assigned to the presenter without lived experience. In the depersonalized condition, 14 participants were assigned to the presenter with lived experience, and 15 were assigned to the presenter without lived experience. With regards to which year of the BEd program participants were in, 63 participants responded and most (44) were in the first year. With regards to whether they were in the primary or secondary BEd program, 67 participants responded and most (53) were in the secondary program. Participants reported teachable subjects of social studies (15 participants), science (13 participants), English (12 participants), mathematics (nine participants), physical education (six participants), fine arts (six participants), French (five participants), family studies (four participants), diverse cultures (one participant), and business (one participant).

Quantitative Analysis

Mixed ANOVAs with one within-participants factor (time: before and after participating in the KT activity) and two

between-participants factors (presenter: with and without lived experience with ADHD; content: personalized and depersonalized) were performed for five survey questions that evaluated participants' attitudes about students with ADHD as well as the role of the brain versus social factors in ADHD. All questions were associated with a main effect of time, in which participants' answers indicated reduced beliefs that a lack of self-discipline and willpower contributed to ADHD symptoms, reduced willingness to punish students for ADHD symptoms, decreased belief that ADHD symptoms can be attributed to social factors such as parental discipline, and increased belief that ADHD symptoms can be attributed to the brain (Table 1; $ps < .05$). For the question “To what degree do you attribute ADHD symptoms to the brain?”, a main effect of content was also observed ($F(1, 54) = 9.51, p = .003$), such that participants assigned to the depersonalized condition attributed ADHD symptoms to the brain more than participants in the personalized condition. This effect was not associated with the KT activity. In addition, for the question “To what degree do you attribute ADHD symptoms to social factors (e.g., parental discipline)?”, a time * content interaction was significant ($F(1, 54) = 4.82, p = .033$). The personalized content was associated with a greater decrease in beliefs about the impact of social factors than the depersonalized content (Figure 1). None of the other main effects or interactions were significant for these survey questions.

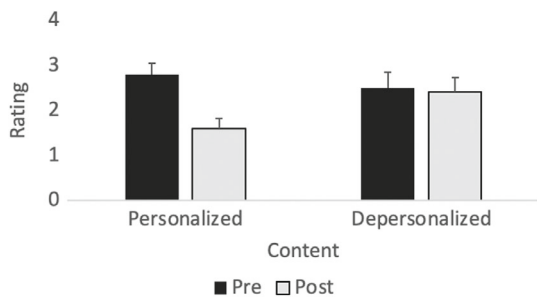


Fig. 1. Impact of personalizing knowledge translation (KT) content on attribution of attention deficit hyperactivity disorder (ADHD) symptoms to social factors. Participants were asked to provide a rating out of seven in response to: “To what degree do you attribute ADHD symptoms to social factors (e.g., parental discipline).” A rating of one corresponded to “Not at all” and a rating of seven corresponded to “Completely.” A significant interaction was observed such that ratings decreased more after the KT activity with the personalized content than the KT activity with depersonalized content. Error bars represent standard errors.

A multivariate between-subjects 2×2 (content \times presenter) ANOVA was performed to evaluate the participants’ post-activity ratings of whether personal stories helped them contextualize the neuroscience, the quality of the information, and the quality of the speaker. A significant effect of the presenter’s lived experience was observed, such that participants with the presenter who had an ADHD diagnosis rated the personal stories as more helpful for contextualizing the neuroscience, compared to the participants with the presenter without an ADHD diagnosis (presenter with ADHD diagnosis: $M = 6.52$, $SE = 0.19$; presenter without ADHD diagnosis: $M = 5.81$, $SE = 0.24$; $F(1, 63) = 7.98$, $p = .012$). In addition, a significant presenter \times content interaction was observed, such that the quality of the information ($F(1, 63) = 7.75$, $p = .002$) and the quality of the speaker ($F(1, 63) = 2.27$, $p = .044$) were rated higher for the presenter with an ADHD diagnosis in the personalized condition and higher for the presenter without an ADHD diagnosis in the depersonalized condition (Figure 2). None of the other main effects or interactions were significant.

Qualitative Analysis

Qualitative analysis was completed on five items in the pre- and post-activity surveys. Data were aggregated from all four groups. Examples are noted in italics below for readability.

First, the participants were asked about what they knew about ADHD prior to the workshop. Within the sample, 29 participants indicated having a personal connection with ADHD, by either having it themselves, or knowing a family member, friend, or colleague who is living with the condition. An additional 19 participants described their understanding of ADHD in terms of diagnostic criteria,

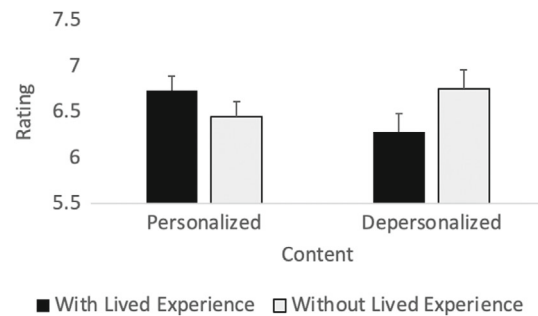


Fig. 2. Interaction between presenter (with/without lived experience) and content (personalized/depersonalized) in speaker quality ratings. Participants were asked to provide a rating out of seven in response to “Rate the quality of the speaker.” A rating of one corresponded to “Ineffective” and a rating of seven corresponded to “Very effective.” A significant interaction was observed, such that speaker quality was rated higher for the presenter with lived experience in the personalized condition, and the presenter without lived experience in the depersonalized condition. Error bars represent standard errors.

or symptoms associated with ADHD. Eight participants indicated that they did not know about ADHD, or lacked specific knowledge about ADHD prior to the workshop. Further, three participants described ADHD in negative terms (e.g., *typically I can tell when they have forgotten their medication because they talk more, and struggle to keep on topic*), while another three participants described ADHD emphasizing individual strengths (e.g., *...exceptional students when supported properly*). Two participants described a brain basis for ADHD, or identified that there is a lack of support for students with ADHD. Three participants also shared false or inaccurate information when describing ADHD (e.g., *[ADHD is] more common than ever before, [students with ADHD are] very detail-oriented*).

Next, the participants were asked about the strategies they were aware of to support students with ADHD. The participants appear to have knowledge of several types of support that could be made available for students with ADHD. These include behavioral support (e.g., token economies, reward systems, body breaks; 48 participants), task accommodations (e.g., smaller assignments, choice in assessments, changing of student outputs or products; 28 participants), environmental supports (e.g., adaptations to the classroom environment, including seating arrangements, quiet spaces, fewer distractions; 10 participants), medical treatments (e.g., medications or clinical counseling; nine participants), and teacher attitude and approach (e.g., being strength-based, acknowledging difficulties; four participants). Overall, it appears that pre-service teachers know a great deal about supporting students with ADHD.

Following the KT activity, the participants were asked how knowing about neuroscience would influence their

teaching. Most commonly, the participants indicated that this knowledge would improve their teaching practices (36 participants). This was further indicated through changes in teacher attitude (e.g., *ADHD as a difference rather [than a] disability*; 11 participants), being more observant of student needs (e.g., *Provide the necessary help to help them succeed*. 10 participants), providing learning accommodations (e.g., ... *I will cater to the needs of my specific students. I will use differentiated strategies*. nine participants), adjusting teaching and planning practices (e.g., *understanding of student needs, treat students with ADHD in ways their brain will comprehend [or] process better*; six participants), and seeking additional resources to support students with ADHD (two participants). Beyond changes to teaching practices, the participants indicated that symptoms of ADHD were not the fault of the student with ADHD (11 participants), that they observed a connection between the brain and behaviors associated with ADHD (nine participants), that each individual with ADHD may present differently (four participants), and that brain-based research into ADHD is important and valuable (three participants).

Further, the participants were asked about how hearing about the lived experience of individuals with ADHD influenced them. Most commonly, the participants indicated that hearing about the lived experiences increased their empathy (e.g., *I will have empathy and increased understanding for students struggling with ADHD because I now know that struggling with ADHD symptoms can negatively impact their self-esteem as well as their school performance*; 20 participants). Participants further noted that hearing about lived experiences would change their teaching (e.g., *hearing about how they function with ADHD has given me better insight into how to better work with them*; 11 participants). They also noted that there are different presentations of ADHD (e.g., *being aware, especially of girls who might not be displaying symptoms of ADHD in the classroom*; 10 participants). Additionally, the participants indicated a heightened sense of awareness about experiences of ADHD (seven participants), as well as the need to listen to their students (two participants).

The final question asked of the participants was about any final key message or takeaway from the ADHD workshop. Most commonly, the participants left with a greater understanding of the brain's role in ADHD (18 participants) and the spectrum of presentations of ADHD (13 participants). Additional takeaways were to have a strength-based approach to working with individuals with ADHD (eight participants), knowledge to improve teacher practice (five participants), knowing the high prevalence of ADHD in classrooms (four participants), personal connections between the presenter or themselves (three participants), and identifying the need to learn more about ADHD (one participant). As one participant noted: "... we are going to

have students with ADHD. It is important to understand that ADHD is in the brain."

DISCUSSION

Summary of Results

We applied a previously-developed KT activity for educating pre-service teachers about the neuroscience of ADHD. We used an experimental design to determine the impacts of sharing a personal story and a presenter with an ADHD diagnosis on the effectiveness of the KT activity. Consistent with previous results (Isenor et al., 2021), we found that our participants had an increased understanding and awareness of the brain basis of ADHD after participating in the KT activity. Novelty, we found that personalized content was more effective at reducing the attribution of ADHD symptoms to social factors such as parental discipline, compared to depersonalized content. We also found that the personal story was rated as more helpful for contextualizing the neuroscience content when the presenter had an ADHD diagnosis compared to the presenter without an ADHD diagnosis. In addition, we found that the quality of the information and the quality of the speaker were rated higher for the presenter with an ADHD diagnosis in the personalized condition and higher for the presenter without an ADHD diagnosis in the depersonalized condition. Note that the presenter without an ADHD diagnosis was a neuroscience expert.

The aggregate qualitative results signaled that pre-service teachers have a great deal of personal experience with individuals with ADHD (through themselves, family members, colleagues, or students), but do not necessarily know or understand the underlying neuroscience or cause for behaviors associated with ADHD. As in the previous study (Isenor et al., 2021), pre-service teachers know a number of strategies available to them to support students with ADHD, but they do not appear to have a clear understanding as to how or why these strategies work or may be necessary. Neuroscience knowledge may help teachers implement these strategies effectively or more frequently. For example, in a previous study of a neuroscience training program for teachers, teachers reported that the neuroscience training gave them more confidence to implement some pedagogical strategies that they were already aware of (Dubinsky et al., 2019).

Role of Personal Story

In the previous study, qualitative results suggested that the personal story of the presenter with ADHD was very impactful in our neuroscience KT activity (Isenor et al., 2021). In the current study, we experimentally manipulated whether the content was presented in a personalized or depersonalized manner. We found that the KT activity with personalized content was associated with a greater decrease in beliefs

about the impact of social factors on ADHD compared to the depersonalized content. This finding suggests that personal stories may be particularly powerful for overcoming ADHD misconceptions related to social factors. The value of storytelling in the KT process has been described previously (Bourbonnais & Michaud, 2018); however, to our knowledge, this is the first time it has been evaluated experimentally.

Role of a Presenter with Lived Experience

The nature of the experimental design necessitated two different presenters be compared in order to ascertain the impact of a presenter with and without an ADHD diagnosis on KT's effectiveness. We did not observe a main effect of presenter, which was reassuring as such a main effect might have been attributed to multiple possible confounds, such as one speaker being more engaging. When comparing the groups assigned to the presenter with lived experience with ADHD versus the presenter without lived experience, we did not observe any differences in changes in attitudes towards ADHD or beliefs about social versus brain explanations of ADHD. This suggests that presenters without ADHD can be effective KT facilitators. From the current experimental design, it is not possible to discern the impact of the neuroscience expertise of the presenter without an ADHD diagnosis; however, by demonstrating that at least some individuals without an ADHD diagnosis can effectively deliver this KT, this finding increases the feasibility of delivering the KT to a wider audience. Further, it greatly increases the possible neurodevelopmental conditions and other issues that might be tackled with a similar KT approach, for which it may be difficult to identify a willing presenter with lived experience, and relatively easier to identify a neuroscience expert willing to engage in KT to teachers. It is important, however, to ensure that individuals from these communities are still engaged in the development of the KT activities (Bernard et al., 2023; Gillespie-Lynch et al., 2022).

We observed several effects related to the presenter factor which highlighted the complexity of developing effective KT and suggest that facilitators with lived experience confer several advantages. Participants assigned to the presenter who had an ADHD diagnosis rated the personal stories as more helpful for contextualizing the neuroscience, compared to the participants assigned to the presenter without an ADHD diagnosis. In the personalized condition, the quality of the information and the quality of the speaker were also rated higher for the presenter with lived experience versus the presenter without lived experience. This finding is consistent with previous teacher professional development research, which found teacher engagement was related to the credibility and authenticity of both the content and the presenter (Harper-Hill et al., 2022). However, in the

depersonalized condition, we found that the quality of the information and the quality of the speaker were rated higher for the presenter without lived experience. This may relate to the fact that, in our study, the presenter without an ADHD diagnosis was a neuroscience expert, which may have conferred credibility and authenticity in that aspect of our KT activity. Our results suggest that personal stories are best shared by the original source, but that depersonalized versions shared by a presenter without lived experience may also be effective for KT. By finding that a neuroscience expert without an ADHD diagnosis can deliver this KT activity effectively, our work improves the feasibility of delivering this KT activity to more teachers. That is, we can capitalize on willing neuroscience experts to help educate teachers about the neuroscience of ADHD, and thereby reduce the burden of affecting positive change on those with ADHD diagnoses.

Limitations and Future Work

Given that participants elected to attend these workshops, it is possible that they already had an interest in neuroscience and ADHD. In fact, almost 40% of our participants indicated they had a personal connection to ADHD. Our KT activity may be less effective for other audiences who are less personally connected to ADHD, and more work is needed to evaluate this possibility and identify strategies to engage educators who are not as intrinsically motivated to better support their students with ADHD. It is also likely that our results include observer-expectancy effects, especially for the main effect of time (pre- versus post-activity). Although participants were not aware that the KT activities were different from other groups, and were randomly assigned to their group, it was not possible to fully mask the conditions from the participants given the nature of the KT activity. Incorporating a waitlist control group in future work could help elucidate the impact of the participants being aware of the nature of the study on our results.

Future work should include longitudinal data collection to evaluate whether changes observed in the current study impact teaching practice. Previous work on university-school partnerships found that expert-led public lectures were impressive and inspiring for teachers, but the teachers often found the material difficult to implement in practice (Wang & Wong, 2017). In addition, future work should incorporate multiple presenters in each condition, and more presentations by each presenter, in order to evaluate the generalizability of our results. Larger sample sizes will also be important for future work, for example, to understand the impact of teacher gender on KT's effectiveness and the potential interaction between KT's effectiveness and how teachers may differentially perceive students of different genders in their classrooms.

There is potential to expand this work to improve empathy for other neurodivergent groups. In fact, meeting the needs of diverse learners has been put forth previously as a motivation for improving teacher neuroscience knowledge (Coch, 2018; Walker, Hale, Annabel Chen, & Poon, 2019). However, while improving the neuroscience knowledge of teachers is likely to have benefits for neurodivergent students, it is important to be aware of the potential drawbacks of brain-based explanations of mental disorders. For example, the mixed-blessings model acknowledges the complexities of stigma related to mental disorders, and posits that while biogenetic explanations can diminish the blame of the individual, such explanations can also increase pessimism and avoidance (Haslam & Kvaale, 2015). Further, neurobiological explanations of mental disorders have been associated with increased stigma without concomitant decreases in blame (Loughman & Haslam, 2018). We propose that combining neuroscience KT with lived experience and personal stories may help reduce the potential for brain-based explanations to increase stigma. Co-design or participatory research could be used to engage populations to develop KT activities collaboratively without having to lead the project or deliver the activities, taking some of the burden off these groups (Collings, Dew, & Dowse, 2021; Gorter, Galuppi, Gulko, Wright, & Godkin, 2017; Spassiani, Parker Harris, & Hammel, 2016). Further, our KT activity incorporated a strengths-based approach and highlighted the importance of valuing neurodiversity, a conceptual shift that may help reduce stigma (Turnock, Langley, & Jones, 2022). Our neuroscience KT strategy could also be extended to other audiences (e.g., post-secondary educators, law enforcement).

Conclusions

When delivering an activity co-designed by an individual with lived experience, we found that effective KT on the neuroscience of ADHD for a pre-service teacher audience can take place even when the presenter does not have lived experience themselves; in our study, a neuroscience expert without an ADHD diagnosis facilitated an equally effective KT activity. While incorporating lived experience is important for authentic and impactful KT, we demonstrated that the KT presenters themselves need not have lived experience to change pre-service teacher attitudes and beliefs. In doing so, we have reduced a potential barrier to effective, authentic neuroscience KT to educator audiences. Replication studies with more presenters and sessions are called for to confirm these results.

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CONFLICT OF INTEREST

The authors have stated explicitly that there are no conflicts of interest in connection with this article.

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