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Improvements in School Professionals' Knowledge and Self-Efficacy After Completing CDC HEADS UP to Schools Online Training

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Abstract

Background: School professionals, including classroom teachers, school administrators, psychologists, teachers' aides, and nurses, often interact with students with concussions. To ensure they have the knowledge to identify and manage concussions, the U.S. Centers of Disease Control and Prevention developed the HEADS UP to Schools online training.

Methods: The HEADS UP to Schools training includes a pre-test and post-test consisting of 16 knowledge questions in three areas (symptom recognition, school support and accommodation, and guidance and recommendations for school staff) and five self-efficacy questions. Pre- and post-test responses of 8750 individuals were compared and analyzed to evaluate the effectiveness of the training.

Results: Respondent scores significantly improved between pre- and post-test responses for all knowledge questions and self-efficacy questions.

Implications for School Health Policy, Practice, and Equity: Schools and school districts may consider offering this training to staff to help ensure that at least one person at each school is trained on concussion and to increase awareness of evidence-based practices.

Conclusions: Knowledge and self-efficacy on concussion identification and management improved among school professionals who completed the HEADS UP to Schools training. Future research to assess whether concussion knowledge and self-efficacy are maintained long term may be beneficial.

This article is a U.S. Government work and is in the public domain in the USA.

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Disclosure

The findings and conclusions in this manuscript are those of the authors and do not necessarily represent the official position of the U.S. Centers for Disease Control and Prevention.

Ethics Statement

CDC determined that data collection was not subject to Institutional Review as the data were collected as part of the regular function of the training and designed for training improvement and evaluation.

Conflicts of Interest

The authors declare no conflicts of interest.

Keywords

concussion; education; school professionals; training; traumatic brain injury

1 | Introduction

Concussions and other traumatic brain injuries (TBI) are common injuries among children and may be more prevalent as children reach school age and adolescence [1, 2]. Data from a pilot study of the U.S. Centers for Disease Control and Prevention (CDC) National Concussion Surveillance System found that approximately 10% of school-aged children were reported to have sustained a concussion in the preceding 12 months of the survey [3]. Sports- and recreation-related activities, including contact sports and playground activities, are associated with the majority of concussions among children [3–5]. Symptoms of a concussion (e.g., headache, fatigue, sensitivity to light and noise, trouble concentrating) are usually most severe within the first few hours or days of the injury [6]. Concussion symptoms generally subside within 2–4 weeks post- injury [7–9]. However, for a subset of children, concussion symptoms may persist for months or longer [6, 10, 11]. While the length of recovery varies, one study demonstrated that 9 out of 10 children who were actively symptomatic and not yet recovered experienced at least one concussion symptom that affected them academically during their recovery [12].

Research shows that prompt return to school and light physical activities (e.g., taking walks) following a concussion can shorten a child's recovery [13]. To this end, current guidelines recommend that children with a concussion: (1) return to school within 2 days of their injury even if they are experiencing some concussion symptoms, and (2) receive short- or long-term accommodations to their workload and schedule as needed [14]. School professionals—ideally as part of a concussion management team—should manage, monitor, and adjust, as needed, short- or long-term accommodations a child receives when they return to school [14].

Supporting a student with a concussion on returning to school is critical to their recovery. However, a recent survey by the National Center for Education Statistics found that only 58% of public schools have someone at the school who is trained on how to help students adjust back into classroom activities after a concussion or other TBI [15]. Previous studies also demonstrate that school professionals may struggle with identification of concussion symptoms and managing the return to school process and that most school protocols and policies are solely focused on sports-related concussions [16–18]. In fact, an analysis by Thompson and colleagues found that only 8 out of 50 states cover return-to-school in their state concussion law, and that almost half of state concussion laws are restricted to student-athletes, excluding students who sustained concussions through non-sport-related mechanisms [18].

To fill this information gap and support schools with the management of student concussions that occur both during and outside of sports, CDC created the HEADS UP to Schools Online Training for School Professionals (HEADS UP to Schools training). The training is part of the CDC HEADS UP education campaign [19], which includes educational materials

on concussion symptom identification, response, and management for a wide variety of audiences (e.g., school professionals, healthcare professionals, parents of youth athletes, youth and high school sports coaches and officials). The HEADS UP to Schools training includes video-based instructions, which take approximately 45 min to complete and is available at no cost. The training includes information on: (1) how a concussion may affect a student's learning, emotions, and behavior; (2) the benefits of matching accommodations to a student's individual symptoms and needs; and (3) facilitation of communication and concussion management planning with a student's parents and healthcare providers. Prior to and following completion of the training, school professionals are directed to complete a pre- and post-test. Responses to the pre- and post-test were designed to assess changes in concussion knowledge and self-efficacy related to concussion identification and management among school professionals. Changes in knowledge and self-efficacy (i.e., confidence in one's ability to enact a behavior) are commonly used in evaluations of educational interventions [16, 20–22]. While knowledge may demonstrate changes in learning, self-efficacy can serve as an indicator for intentions and behaviors [20–22], as well as a predictor of motivation and performance [23].

Building upon prior efforts to evaluate the effectiveness of other CDC HEADS UP educational efforts, the goal of this evaluation was to describe findings from the CDC HEADS UP to School training pre-test and post-test modules. Findings from this evaluation may not only help CDC update the HEADS UP to School training but may also help determine whether this online training is an effective tool for schools and school districts looking for a cost-effective and efficient way to train staff and improve concussion identification and management for their students.

2 | Methods

2.1 | Participants

Participants included 10,029 classroom teachers (grades K-12), school administrators, school psychologists or counselors, teachers' aides or paraprofessionals, nurses, and other staff who work with students, such as before and after school assistants, librarians, and school lunch staff. These individuals initiated the HEADS UP to Schools training and both the pre- and post-tests between August 01, 2023 and July 31, 2024. While 10,029 individuals initiated the HEADS UP to Schools training during the study period, 1279 individuals did not complete the post-test. As such, they were excluded from the analysis, resulting in a final analytic sample of 8750 individuals.

2.2 | Instrumentation

The HEADS UP to Schools training includes embedded pre- and post-tests with 16 knowledge questions and five self-efficacy questions in both tests. The 16 knowledge questions were focused on three areas: (1) symptom recognition, (2) school support and accommodation, and (3) recommendations for school staff (Table 1). Questions were composed of multiple choice, true/false, and check all that apply formats.

The self-efficacy questions were created to assess school professionals' confidence related to identifying symptoms in students and awareness of recommendations and management of concussion (Table 2). The self-efficacy questions were each measured on a 5-point Likert scale ranging from “*strongly disagree*” to “*strongly agree*.” Respondents received 1–5 points for each item, with higher scores indicating a greater level of agreement and self-efficacy with each statement.

Additional questions on respondent demographics were also included in the pre-test module of the training. These included questions on respondent profession, school setting, grades respondents work with, and the zip code for the geographic region in which they work. Zip codes were used to determine respondent urbanicity status, using the 2013 NCHS Urban-Rural Classification Scheme for Counties [24]. The post-training assessment also included one question on whether the respondent would recommend the online training.

CDC determined that data collection was not subject to Institutional Review as the data were collected as part of the regular function of the training and designed for training improvement and evaluation.

2.3 | Data Analysis

Descriptive statistics for study variables were computed using the sample of school professionals who completed the pre-test and the post-test. Responses to the 16 knowledge questions were re-coded for analysis such that correct responses = 1 and incorrect responses = 0. Percentage correct per question was calculated for the knowledge questions, and statistical differences between responses to the pre- and post-test were assessed through McNemar's test. For the five self-efficacy questions, medians were reported due to the ordinal nature of the 5-point Likert scale data. Wilcoxon signed rank tests for paired observations were conducted to test for the differences in the responses to the self-efficacy questions pre- and post-test. Additionally, effect sizes for the self-efficacy questions were calculated using the Z-score of the Wilcoxon signed rank test [25]. An r between 0.10 and 0.30 was considered to have a small effect size, an r of 0.30–0.50 to have a medium effect size, and an r greater than 0.50 to have a large effect size [25]. All analyses were conducted using R 4.2.2.

3 | Results

About 39.0% of respondents were classroom teachers, 20.8% were nurses, 13.2% were educational assistants, 12.0% were other school professionals, 7.1% were school psychologists or counselors, and 6.3% were school administrators (Table 3). Half (50.7%) of respondents reported teaching in a public-school setting, while one in three (33.7%) reported working in a private school setting. The largest group (39.1%) of respondents reported working with either elementary school students (K-5) or with students across multiple grades (28.4%). Approximately three-fourths (74.4%) reported working in a medium-large metropolitan setting, while 20.2% reported working in a rural-small metropolitan setting. Additionally, almost all (97.8%) respondents reported that they would recommend this training to others.

All 16 knowledge questions had statistically significant increases in correct responses from pre- to post-test (Table 4). Regarding symptom recognition, pre-test results revealed that 27.5% of respondents could correctly identify common physical symptoms students might experience following a concussion, and 7 out of 10 respondents knew why a concussion was called an invisible injury (71.9%), correct signs of a concussion (71.2%), and common cognitive symptoms of a concussion (69.6%). Nine out of ten respondents knew that feeling more anxious and sad were possible symptoms after a concussion (89.3%) and that most concussions occurred without loss of consciousness (89.2%), and nearly all respondents (99.2%) knew that a concussion could change how a student behaves, moves, thinks, and learns. The largest changes between pre- and post-tests included a 28.8 percentage point increase in knowledge of common physical symptoms following a concussion (27.5%–56.3%, $p < 0.0001$) and a 25.4 percentage point increase in knowledge of common signs following a concussion (71.2%–96.6%, $p < 0.0001$). Notable differences were also observed in respondents knowing why a concussion is sometimes called an invisible injury (9.1 percentage point increase, $p < 0.0001$), common cognitive symptoms following a concussion (12.3 percentage point increase, $p < 0.0001$), and that students may feel more anxious and sad after a concussion (10.3 percentage point increase, $p < 0.0001$). Following training, nearly all knowledge scores related to symptom recognition were above 80%, and many were above 90%, with the exception of knowing all common physical symptoms of a concussion (post-test: 56.3%).

Among the knowledge questions centered around school support and accommodation, there was a statistically significant improvement in the percentage of respondents who answered correctly after taking the training for all five questions (Table 4). The largest change between pre- and post-test was observed for knowledge in understanding which accommodations might be helpful for a student who is overwhelmed by a lengthy, multi-step project. The proportion answering correctly increased from 25.2% to 63.1% from pre- to post-test (37.9 percentage points, $p < 0.0001$). This large increase was followed by a nearly 30% increase in knowledge that most students would not require a 504 plan when they return to school. The proportion answering this question correctly increased from 57.0% to 86.9% ($p < 0.0001$). Additionally, there was a 25.7 percentage point ($p < 0.0001$) increase, from 60.3% in the pre-test to 86.0% in the post-test, around knowledge of support tools that might help students struggling to keep track of homework and in-class assignments. Lastly, the percentages of correct responses to the questions asking about effective ways to help students manage concussion symptoms and the importance of monitoring a student's symptoms and school performance after a concussion were smaller, with correct responses increasing by 8.9 percentage points ($p < 0.0001$) and 6.5 percentage points ($p < 0.0001$), respectively. However, these two school support questions had the highest proportion responding correctly in the pre-test, with less room for growth.

Responses for all four questions focused on staff recommendations also showed statistically significant improvement between pre-test and post-test (Table 4). The questions assessing knowledge on effective approaches to facilitate communication among school staff about a student with a concussion and about identifying important members of a Concussion Management Team both had large changes between pre- and post-test, with the first improving from 64.9% to 92.2% (27.3 percentage points, $p < 0.0001$) and the second from

74.2% to 97.2% (23.0 percentage points, $p < 0.0001$), respectively. The other two questions had smaller percentage changes. There was a 9.2 percentage point increase (pre-test correct: 80.3%, post-test correct: 89.5%, $p < 0.0001$) in knowledge around discussing a student's concussion symptoms with other school professionals and a 6.1 percentage point increase (pre-test: 46.2%, post-test: 52.3%, $p < 0.0001$) in identifying good examples of the best way(s) for the school team and healthcare provider to communicate about a student's needs.

Finally, responses to the five self-efficacy questions had statistically significant increases in respondent confidence after taking the training modules (Table 5). Across all five questions, the difference in confidence between the pre-test responses and the post-test responses demonstrated a large practical significance ($r > 0.50$). There was an increase in the responses from a pre-test median score of 4 (“agree”) to a post-test median score of 5 (“strongly agree”) for the self-efficacy questions related to confidence in identifying concussion symptoms in students ($p < 0.0001$, $r = 0.71$), ability to provide accommodations for students ($p < 0.0001$, $r = 0.62$), and ability to manage students' return to school ($p < 0.0001$, $r = 0.64$). Although the median response scores for both pre- and post-test remained a 5 (“strongly agree”) for questions related to confidence in the ability to collaborate with the school team ($p < 0.0001$, $r = 0.52$) and ability to communicate with parents ($p < 0.0001$, $r = 0.52$), the proportion responding “strongly agree” increased between the pre- and post-test. For both questions, approximately half of respondents responded with “strongly agree” in the pre-test, but over 80% reported strongly agreeing after completing the training (Table 5).

4 | Discussion

The HEADS UP to Schools online training was created to increase awareness of evidence-based strategies for school professionals on identification and management of concussion among students (K-12) from any mechanism (sports- or non-sports-related). This study found that school professionals who completed the HEADS UP to Schools training improved in all knowledge areas (symptom recognition, school support and accommodation, and guidance and recommendations for school staff), as well as the self-efficacy measures captured in the pre- and post-tests. These findings are consistent with previous research that shows that concussion training for school professionals may enhance their knowledge, skills, and self-efficacy [16, 26]. In addition, use of the training by almost 9000 school professionals (predominately by classroom teachers) during a one-year period suggests that this training is an efficient way to deliver training to school professionals nationwide. Taken together, the HEADS UP to Schools training may serve as an important tool for school and district leaders looking to improve concussion identification and management (for all students independent of how the injury occurred) and possibly help to better standardize return-to-school processes by providing consistent information on this topic. As this analysis evaluated changes in knowledge and self-efficacy immediately following the training, future efforts that assess whether positive gains from the training are sustained long term and/or whether follow-up trainings or educational tools are needed may be beneficial.

Following completion of the training, post-test results indicated that concussion symptom-related knowledge and self-efficacy improved among participants. On average, accuracy

in response to the symptom recognition questions improved by 18%, school support and accommodation questions by 36%, and staff recommendation questions by 25% between pre- and post-test. Interestingly, knowledge of physical symptoms was lowest in the pre-test scores among participants. A little more than a quarter of respondents (27.5%) answered the question on physical symptoms correctly during the pre-test. While the results improved, 43.7% of participants still did not indicate the correct responses on the post-test. A post hoc analysis found that while many participants were able to correctly select concussion symptoms in the list of the “check all that apply” answer choices, participants often also included the incorrect, non-concussion symptoms in their responses as well. Two possible explanations may include participants having difficulty in distinguishing concussion symptoms from other possible health issues and challenges with the “check all that apply” question format. More interactive components in the training to reinforce recognition of physical symptoms of concussion, as well as use of printed symptom checklists may be beneficial. Additionally, other questions in the “check all that apply” format have shown lower percentage correct responses as well. Adjusting the format of these questions from “check all that apply” or reducing the number of response options may limit potential information overload among respondents and more accurately capture any improvements in respondent knowledge after completing the training. Findings indicate that most school professionals were familiar with concussion-related mental health and cognitive symptoms prior to taking the training, but still improved significantly in that knowledge, with 81.9% of participants answering questions on cognitive symptoms correctly and almost all participants (99.6%) answering questions on mental health symptoms correctly in the post-test. Given the increased risk of mental health issues following a concussion [27–29], leveraging school professions’ knowledge in identifying these symptoms could help provide early interventions and reduce long-term mental health outcomes following a concussion.

Proper management through school concussion protocols can help reduce a student’s risk for adverse outcomes and a delayed recovery following a concussion [30, 31]. Use of accommodations and guidance from staff, including through concussion management teams and communication with healthcare providers, are key components of return to school concussion protocols and guidelines [32–34]. Findings from this study show that knowledge and self-efficacy on these topics increased among school professionals following completion of the HEADS UP to Schools training. Medium and large changes in knowledge were seen for questions related to types of accommodations, roles of the Concussion Management Team, and approaches to facilitate communication among school staff about a student with concussion. An assessment of whether school professionals applied their knowledge to implement accommodations, management teams, and communication channels with healthcare providers may help inform future updates to the CDC training.

4.1 | Limitations

While knowledge, and in particular self-efficacy, can serve as predictors for behavior change, findings from this study do not assess whether the training resulted in long-term changes in concussion identification and management practices. It is unclear whether school professionals maintained their increase in knowledge and self-efficacy over time. Future studies on whether completion of the HEADS UP to Schools training is associated with

increased use of evidence-based strategies on concussion identification and management may be beneficial. Another consideration pertains to the self-efficacy questions and the potential influence of social desirability. As the self-efficacy questions were self-reported to assess respondent confidence, respondents' answers may have been influenced by social desirability and potentially selected what they assume is "correct" or what "should" be the answer.

In addition, data from the pre- and post-test modules were obtained from a convenience sample of school professionals who completed this training, and as a result, may not be generalizable to the general population. Furthermore, the study did not have a control group, who would complete the pre- and post-tests without completing the training, to serve as a comparison group when assessing the differences in pre- and post-test. Finally, there is also the potential that the format of the multiple choice and true/false questions, due to respondents having a 25%–50% chance of randomly guessing the correct response, led to overestimation of respondents' level of knowledge.

4.2 | Implications for School Health Policy, Practice, and Equity

According to a survey of school principals in 2024, almost 40% of public schools have had to support students returning to the classroom after sustaining a concussion or other TBI [15]. Yet, research suggests that there is substantial variation in how concussions are managed in schools [18] and one-quarter of schools do not have a formal concussion management plan in place [17]. Moreover, many schools do not have a designated person trained in concussion management and do not consistently use concussion management teams to support students with a concussion [9, 11, 31]. Importantly, students who sustain a concussion outside of a sports-related activity are less likely to receive attention as they are not covered in most school-based concussion policies [35]. Greater use of school-based injury surveillance programs that can inform prevention strategies may be beneficial [4].

Training on concussion can build confidence among school professionals on how to identify and respond to concussion and facilitate the use of services and support for children who may be struggling in the classroom after this injury [1, 3, 4]. School professionals can get trained on concussion, at no cost, through the CDC HEADS UP to Schools online training available at: <https://www.cdc.gov/heads-up/training/school-professionals.html>. School professionals can also access tools and stepwise return-to-school protocols in the HEADS UP to Schools training to support the implementation of school or school district concussion management plans.

5 | Conclusions

The HEADS UP to Schools training is an efficient and cost-effective way to deliver training to school professionals. Findings from this training's evaluation data suggest the use and completion of this training by school professionals can improve knowledge and self-efficacy related to concussion identification and management. Schools and school districts may consider offering this training to staff to help ensure that at least one person at each school is trained on concussion and to increase awareness of evidence-based practices. Future research to assess whether concussion knowledge and self-efficacy are maintained long term

and whether additional educational reminders, supports, trainings, or educational tools may be beneficial.

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TABLE 1 |

Pre- and post-test knowledge questions and response options in the U.S. Centers for Disease Control and Prevention’s HEADS UP to Schools online training.

Questions	Response options ^d
Symptom recognition	
Why is concussion sometimes called an invisible injury? Select the best option.	A person with a concussion may look physically unharmed despite their injury. Concussions are uncommon among children. People with a concussion often have other internal injuries. People with a concussion do not always experience symptoms immediately after the injury.
True or false? A concussion can change how a student behaves, moves, thinks, and learns.	True False
Which of the following are common signs of concussion? Check all that apply.	The student is confused about things going on around them. The student answers questions more slowly than usual. The student repeats questions that have already been answered. The student forgets assignments.
Which of the following are common physical symptoms of concussion a student might experience? Check all that apply.	Bothered by light or noise Dizziness or balance problems Fatigue (feeling tired), lack of energy Headaches Nosebleed Vision problems Loss of sense of smell Sleep problems Strange taste in mouth Trouble concentrating Feeling “foggy” or groggy Problems with short- or long-term memory Shortness of breath
Which of the following are common cognitive symptoms of concussion a student might experience? Check all that apply.	True False
True or False? Feeling more anxious and sad are possible social/emotional symptoms after a concussion.	True False
True or false? Most concussions occur without a loss of consciousness.	True False
School support and accommodation	
True or false? Most students experiencing concussion symptoms will require a 504 plan when they return to school.	True False
Which of the following are helpful accommodations for a student who is overwhelmed by lengthy, multi-step project? Check all that apply.	Give the student the instructions in both visual and auditory formats. Break the project down into smaller steps and provide them to the student one step at a time. Distill the assignment down to just the most critical parts and adjust the grading requirements based on the adjusted work. Allow the student to skip some projects that may cause unnecessary frustration.
Which of the following are examples of effective ways to help your student manage concussion symptoms? Check all that apply.	Reduce the amount of bright lighting in the classroom. Make sure the classroom temperature is warm. Allow the student to take rest breaks. Push the student to challenge their brain to get it feeling better again.

Questions	Response options ^a
Kio is a middle school student who sustained a concussion. He has begun to struggle with keeping track of homework and in-class assignments. Science class is proving especially difficult. He spent the first 10 min of a recent science class looking for the supplies he would need to complete a lab assignment. He became agitated and frustrated when he was unable to complete the lab in the allotted time. Which of the following support tools might be a good choice(s) for supporting Kio? Check all that apply.	Set up a labeling system for his school supplies. Provide an easily visible calendar with his daily classwork schedule. Send him to detention for falling behind. Update the concussion point person about your concerns.
Why is it important to monitor a student's symptoms and school performance after concussion? Check the best option.	A student recovering from a concussion may have needs that change from day to day. Concussion symptoms always get worse after a few days. Students often use concussion symptoms to get out of doing assignments. Some students may want to rest longer than is needed following a concussion.
Staff recommendations	Student Student's parents/guardians Student's healthcare provider School nurse Teachers Other school staff (e.g., counselors, administrators, athletic staff)
True or false? It is important to not discuss a student's concussion symptoms with other school professionals.	True False
Which of the following are examples of the best way(s) for the school team and healthcare provider to communicate about a student's needs? Check all that apply.	Communicate with the student about what they should tell their healthcare provider about their accommodations. The healthcare provider submits written information for the school about the student's injury and suggestions for possible accommodations the student may need. A designated point at school establishes a consistent method for communication with the student's healthcare provider and parents.
Which of the following are effective approaches to facilitate communication among school staff about a student with concussion? Check all that apply.	A designated point person shares information about the student's injury and possible temporary accommodations with the student's teachers and other relevant school staff. Provide opportunities for teachers/staff to discuss and provide input to the list of accommodations for the student. Establish regular meetings to discuss the student's accommodations and any possible changes.

^aCorrect response options listed as bold text.

TABLE 2 | Self-efficacy questions in the Centers for Disease Control and Prevention’s HEADS UP to Schools online training.

Self-efficacy questions	Response options			
I am confident in my ability to identify concussion symptoms among a student.	Strongly agree	Agree	Neither agree nor disagree	Disagree
I am confident in my ability to provide and modify appropriate accommodations for a student with a concussion.				Strongly disagree
I am confident in my ability to manage the return to school experience for a student following a concussion.				
I am confident in my ability to collaborate with the school team to provide appropriate school supports for a student recovering from concussion.				
I am confident in my ability to communicate with parents about the status and progress of their child with a concussion.				

TABLE 3 |

Background characteristics of respondents who completed the HEADS UP for School Professionals online training between August 01, 2023 and July 31, 2024 ($n = 8750$).

	Frequency	Percent
Profession		
Classroom teacher	3409	39.0%
Nurses	1822	20.8%
Educational assistant	1153	13.2%
Other	1050	12.0%
School psychologist or counselor	619	7.1%
School administrator	548	6.3%
Missing	149	1.7%
School setting ^a		
Private school	2948	33.7%
Public School	4434	50.7%
Both	298	3.4%
Other	1070	12.2%
Grade ^a		
Elementary (K-5)	3421	39.1%
Middle school (6–8)	953	10.9%
High school (9–12)	791	9.0%
Multiple grades (K-12)	2488	28.4%
Other	1097	12.5%
Urban/rural		
Medium-large metropolitan	6514	74.4%
Rural-small metropolitan	1771	20.2%
Missing	465	5.3%

^a Only those reporting exclusively as “Other” assigned as “Other.” If “Other” is reported with another setting or grade, it is combined into the reported setting or grade (e.g., “Private school” and “Other” combined as “private school” or if “Elementary (K-5)” and “Other,” classified as “Elementary (K-5)”).

TABLE 4 |

Comparison of pre- and post-test knowledge questions for respondents who completed the HEADS UP to Schools online training between August 01, 2023 and July 31, 2024 ($n = 8750$).

Questions	Question type	Pre-test	Post-test	Difference		p
		Percent correct	Percent correct	Percent difference ^a	McNemar's statistic	
Symptom recognition						
Why is concussion sometimes called an invisible injury?	Multiple choice	71.9%	81.0%	9.1%	349.2	< 0.0001
A concussion can change how a student behaves, moves, thinks, and learns.	True/false	99.2%	99.9%	0.7%	48.4	< 0.0001
Which of the following are common signs of concussion?	Check all that apply	71.2%	96.6%	25.4%	2030.0	< 0.0001
Which of the following are common physical symptoms of concussion a student might experience?	Check all that apply	27.5%	56.3%	28.8%	1856.3	< 0.0001
Which of the following are common cognitive symptoms of concussion a student might experience?	Check all that apply	69.6%	81.9%	12.3%	514.8	< 0.0001
Feeling more anxious and sad are possible social/emotional symptoms after a concussion.	True/false	89.3%	99.6%	10.3%	863.5	< 0.0001
Most concussions occur without a loss of consciousness.	True/false	89.2%	93.5%	4.3%	124.6	< 0.0001
School support and accommodation						
Most students experiencing concussion symptoms will require a 504 plan when they return to school.	True/false	57.0%	86.9%	29.9%	1975.4	< 0.0001
Which of the following are helpful accommodations for a student who is overwhelmed by lengthy, multi-step project?	Check all that apply	25.2%	63.1%	37.9%	2938.1	< 0.0001
Which of the following are examples of effective ways to help your student manage concussion symptoms?	Check all that apply	74.2%	80.7%	6.5%	161.7	< 0.0001
Kio is a middle school student who sustained a concussion. He has begun to struggle with keeping track of homework and in-class assignments. Science class is proving especially difficult. He spent the first 10 min of a recent science class looking for the supplies he would need to complete a lab assignment. He became agitated and frustrated when he was unable to complete the lab in the allotted time. Which of the following support tools might be a good choice(s) for supporting Kio?	Check all that apply	60.3%	86.0%	25.7%	1785.0	< 0.0001
Why is it important to monitor a student's symptoms and school performance after concussion?	Multiple choice	86.4%	95.3%	8.9%	501.4	< 0.0001
Staff recommendations						
Which of the following are important members of a Concussion Management Team?	Check all that apply	74.2%	97.2%	23.0%	1830.6	< 0.0001
It is important to not discuss a student's concussion symptoms with other school professionals.	True/False	80.3%	89.5%	9.2%	340.9	< 0.0001
Which of the following are examples of the best way(s) for the school team and healthcare provider to communicate about a student's needs?	Check all that apply	46.2%	52.3%	6.1%	96.8	< 0.0001

Questions	Question type	Pre-test		Post-test		Difference		<i>p</i>
		Percent correct	Percent correct	Percent correct	Percent correct	Percent difference ^a	McNemar's statistic	
Which of the following are effective approaches to facilitate communication among school staff about a student with concussion?	Check all that apply	64.9%	92.2%	27.3%	2130.2	< 0.0001		

^a Absolute value of percent difference between pre- and post-test response accuracy.

TABLE 5 |
Comparison of pre- and post- test self-assessment question results from the HEADS UP to School: Online Concussion Training for School Professionals between August 01, 2023 and July 31, 2024 (*n*=8750).

Questions	Pre-test					Post-test					<i>p</i>	<i>Z</i> -score	<i>r</i> ^a
	Frequency	Percent	Median	IQR	Frequency	Percent	Median	IQR	Frequency	Percent			
I am confident in my ability to identify concussion symptoms among a student.			4	3-5			5	5-5			<0.0001	-66.3	0.71
Strongly agree	2317	26.5%			6755	77.2%							
Agree	3136	35.8%			1784	20.4%							
Neither agree nor disagree	2587	29.6%			193	2.2%							
Disagree	562	6.4%			9	0.1%							
Strongly disagree	148	1.7%			9	0.1%							
I am confident in my ability to provide and modify appropriate accommodations for a student with a concussion.			4	3-5			5	5-5			<0.0001	-58.0	0.62
Strongly agree	3602	41.2%			7112	81.3%							
Agree	2924	33.4%			1451	16.6%							
Neither agree nor disagree	1686	19.3%			167	1.9%							
Disagree	420	4.8%			10	0.1%							
Strongly disagree	118	1.3%			10	0.1%							
I am confident in my ability to manage the return to school experience for a student following a concussion.			4	3-5			5	5-5			<0.0001	-59.9	0.64
Strongly agree	3398	38.8%			7066	80.8%							
Agree	2839	32.4%			1485	17.0%							
Neither agree nor disagree	1882	21.5%			174	2.0%							
Disagree	479	5.5%			12	0.1%							
Strongly disagree	152	1.7%			13	0.1%							
I am confident in my ability to collaborate with the school team to provide appropriate school supports for a student recovering from concussion.			5	4-5			5	5-5			<0.0001	-48.7	0.52
Strongly agree	4797	54.8%			7394	84.5%							
Agree	2536	29.0%			1211	13.8%							
Neither agree nor disagree	1146	13.1%			130	1.5%							
Disagree	194	2.2%			7	0.1%							
Strongly disagree	77	0.9%			8	0.1%							

Questions	Pre-test				Post-test				Z-score	p	r ^a
	Frequency	Percent	Median	IQR	Frequency	Percent	Median	IQR			
I am confident in my ability to communicate with parents about the status and progress of their child with a concussion.			5	4-5			5	5-5	-49.0	<0.0001	0.52
Strongly agree	4816	55.0%			7367	84.2%					
Agree	2437	27.9%			1227	14.0%					
Neither agree nor disagree	1173	13.4%			135	1.5%					
Disagree	229	2.6%			12	0.1%					
Strongly disagree	95	1.1%			9	0.1%					

Abbreviation: IQR, interquartile range.

^aTest statistic (Z-score) and p-value computed from the Wilcoxon signed rank test. Effect size (r) computed for each Wilcoxon signed rank test using the test statistic (Z-score) and interpreted in accordance with Cohen [25]. An r≥0.50 indicates a large effect size, 0.30<r<0.50 indicates medium effect size, and 0.10<r<0.30 indicates small effect size.