Brain Breaks: Teacher Usage And Child Preference

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Abstract

Brain breaks are often used during lessons to replenish childrens' attention, but children may respond differently to the variety of brain breaks they are offered. Therefore, two studies were conducted to identify both teachers' current use of brain breaks (Study 1) as well as the types of brain breaks children prefer (Study 2). Study 1 consisted of a survey of K-2 teachers (N = 796) across the United States regarding the implementation and types of brain breaks commonly used in their classrooms. The three most common break types reported by teachers were physical activity breaks, videos, and dancing. Study 2 consisted of a forced choice task in which elementary- and middle-school students were asked to pick between two instantiations of six different break types: cognitive engagement breaks, mindfulness exercises, physical activity breaks, nature videos, coloring, and mind wandering. For each break type, children were asked to pick the instantiation they preferred as well as the one they believed would help them focus. Children were then asked to rank the six breaks they selected from most to least preferred and most to least beneficial for focusing. Data collection is ongoing (N = 53). Preliminary results revealed children were more likely to rank cognitive engagement breaks as their most preferred break type. Analyses within break type revealed that students preferred mazes over pattern blocks as a cognitive engagement break, color jump over calisthenics for physical activity breaks, videos of forest scenery over cows grazing for a nature video break, mandala coloring over abstract coloring as a coloring break, and viewing a poster of a starry sky over an abstract poster as a mind wandering break.

Keywords: Brain Breaks; Attention; Attention Replenishment; Preference; Teacher Survey

Introduction

Inhibitory control, a component of Executive Function (Hughes, 1998; Miyake, Friedman, Emerson, Witzki, Howerter, & Wager, 2000), plays a key role in selective sustained attention (SSA), which is the ability to maintain focus on relevant information while excluding irrelevant stimuli during a task (Akshoomoff, 2002). SSA is a component of endogenous attention, which is a type of top-down, goal-oriented attention. Endogenous attention develops gradually with the development and integration of multiple neural and cognitive factors; the frontal cortex, the front-parietal pathway, and memory encoding and retrieval systems (Colombo & Cheatham, 2006). Recent research has also divided SSA into staying and returning processes, which are reflective of maintaining attention on the task and returning to the task from a distractor, respectively (Kim, Singh, Vales, Keebler, Fisher, & Thiessen, 2023).

However, attention is a limited resource that needs to be replenished over time. Inattention can result in off-task behavior due to the need for a break from continuous cognitive demands. This typically occurs as the cognitively demanding activity reaches 30 minutes in duration (Beserra, Nussbaum, & Oteo, 2019), though other studies estimate attention decays even earlier (Godwin & Kaur, 2020; Sabourin, Rowe, Mott, & Lester, 2011). Prior research has examined different types of off-task behavior including motor, verbal, and passive subtypes, along with studies of the different sources of distraction that can cause off-task behavior which can be split into self, peer, or environmental distractions (Godwin, Almeda, Seltman, Kai, Skerbetz, Baker, & Fisher, 2016; Shapiro, 2004). The importance of research surrounding attention can be partially attributed to concerns regarding learning loss that can result from off-task behavior (Karweit & Slavin, 1981). Off-task behaviors can adversely affect students' own learning and task performance as well as that of their peers, compounding the problems that can arise during lapses in attention (Deng, Zhou, & Hu, 2022; Dixon & Salley, 2006).

One possible intervention that has been implemented in educational settings is brain breaks. Brain breaks are short intervals of break time introduced in between cognitively demanding tasks that are intended to help replenish attentional capacity, which wanes over time (Beserra, Nussbaum, & Oteo, 2019). While brain breaks require instructional time to be temporarily diverted, they are not found to negatively affect learning and perseverance in children (Silvervarg, Haake, & Gulz, 2018). Additionally, brain breaks have been shown to have positive effects on

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heart rate, affect, and promotion of physical activity (Kirby, Kornman, & Robinson, 2021; Stapp & Prior, 2018). In particular, fitness brain breaks have been shown to lead to better performance on math and language tests as compared to a control group engaging in passive break time (Fiorilli, Buonsenso, Di Martino, Crova, Centorbi, Grazioli, Tranchita, Cerulli, Quinzi, Calcagno, Parisi, & di Cagno, 2021).

Brain breaks may also serve as a motivational tool that may help improve attention and learning outcomes. Prior literature has shown a positive effect of choice on feelings of autonomy, which indicates that allowing students to choose their own brain breaks could be one way to increase feelings of autonomy (Beymer & Thomson, 2015). Autonomy in the classroom has been divided into 3 distinct subtypes: organizational, procedural, and cognitive. Brain breaks would fall into the procedural autonomy subtype because students would be able to choose the break procedure they take part in. This can improve engagement with classroom instruction, and could even be necessary for high-engagement learning (Stefanou, Perencevich, DiCintio, & Turner, 2004).

While some prior research has found that brain breaks may have a positive impact on attention and performance it is unclear how brain breaks are currently being deployed in classroom settings. It is also unclear if there are any underlying interactions between the types of brain breaks that are being used and other factors such as grade level, classroom size, and gender ratio. Study 1 aims to describe the current deployment of brain breaks in United States' K-2 classrooms with regards to (1) the types of breaks being used, as well as (2) the most common mode of administering breaks (whole class, small group, or individual). Study 2 aims to determine (1) students' most preferred type of break, (2) whether there is a preference for a certain instantiation within each break type, and (3) whether the breaks that are preferred are also the breaks students perceive as being most beneficial for focusing.

Study 1

Method

Participants The sampling frame included 2,000 K-2 teachers from the RAND American Teacher Panel that were contacted to participate in the study. Of those contacted, 796 teachers participated in the study. Teachers were predominantly white (85.3%) and women (87.5%). Most teachers taught in person (98.0%) representing schools across a mix of settings (suburban, 37.4%, rural, 32.8%, urban, 29.9%) as well as school sizes (449 students or less, 45.9%, 450 or more, 54.1%).

Measure The online survey was designed to take approximately 15 minutes to complete. The authors designed the survey to incorporate a mix of question types, including likert scale, rank order, multiple choice, and open-ended responses. Key questions from the survey discussed here gathered information about the implementation of brain breaks in the classroom, as well as the types of brain breaks most commonly used. Teachers were allowed to pick multiple types of brain breaks that they engaged in during class time. Participants were also asked additional questions about their perceptions of brain breaks, the impact of the COVID-19 pandemic on brain break usage, and their perceptions of the benefits and drawbacks to brain breaks - those data are reported elsewhere (Godwin, Moreno, Leroux, & Kaur, In Preparation).

Procedure The survey was administered to teachers during May 2022 and June 2022. The survey was fielded by RAND (RAND American Educator Panels, [ATP], "Brain Breaks Survey", MBB0222T, RAND Corporation, Santa Monica, CA, [February 2, 2022]).Teachers received an initial email inviting them to participate in the survey as well as follow-up emails if necessary. Teachers received a $15 e-gift card for their participation.

Results

The data were analyzed using survey weights provided by the RAND Corporation to calculate weighted descriptive statistics, percentages, and inferential tests.

Teachers' Brain Break Implementation Most teachers (91.2%) reported implementing brain breaks into their classroom instruction. Brain breaks were typically administered multiple times a day (M = 2.6, SD = 1.6). Breaks were reported to typically last around 5.3 minutes (SD = 2.7 minutes), and most teachers (74.8%) reported administering breaks in between instructional activities (as opposed to during the middle of instruction).

In general, brain breaks were not part of teachers' lesson planning, with most teachers (71.4%) reporting that brain breaks were typically not prepared in advance. Teachers were also asked to report on the format in which they delivered brain breaks (i.e., to individual students, small groups, or to the whole class) from most (1) to least (3) common. Most (91.8%) teachers reported that they administered brain breaks on a classroom level. When asked about the subject area in which teachers were most likely to implement a brain break, over half of teachers (52.7%) chose language arts, which was a significantly larger proportion than expected, $\chi^2(5, N = 721) = 822.63, p < .001$.

Types of Brain Breaks Deployed Teachers often reported using a variety of brain breaks in their classrooms. The three brain breaks that more than half of teachers reported using included physical activity breaks (91.1%), videos (87.0%), and dancing (68.4%). The use of physical activity breaks was consistent across grade levels, but dancing was a more common break type with kindergarten teachers (76.6%) than it was with second-grade teachers (61.3%, p = .02). Instead, second-grade teachers (35.3%) tended to report a higher usage of brain teasers compared to kindergarten teachers (14.3%, $p < .001$).

Discussion

There were several notable findings from this survey. First, the use of brain breaks is pervasive throughout U.S. classrooms. Breaks are typically short (approximately 5 minutes), offering students an opportunity to replenish their attention but not so long as to significantly interfere with instruction, which increases the ease with which teachers can incorporate breaks into their regular classroom routine. However, there is room for improvement in implementation since teachers are not likely to plan brain breaks in advance, and often use whole-classroom breaks as opposed to small-group or individual brain breaks which may result in some level of asynchrony as to when a given child might need a break and when class-wide brain breaks are actually administered.

Additionally, teachers were asked to report the types of brain breaks they used, but were not asked about specific instantiations of the breaks they use within each category. For example, physical activity breaks can encompass a wide variety of activities (e.g., calisthenics, yoga, etc.). Future research can explore potential differences in brain break usage, preference, and efficacy across multiple break instantiations within the same general break type. This could lead to research-based guidelines on effective instantions of brain breaks that teachers could offer to students to best suit students needs without overwhelming them with too many choices, as prior research suggests choice overload (Beymer & Thomson, 2015; Schwartz, 2004) can remove the satisfaction children gain from making decisions.

To avoid students enduring choice overload when selecting an individual brain break, teachers could either offer a smaller assortment of brain breaks to students that are likely to be interesting, or offer a wider variety of brain breaks with fewer instantiations of each break type. The primary motivation behind Study 2 was to begin investigating students' brain break preferences in order to experimentally test the efficacy of students' preferred breaks in future research. This line of research could eventually lead to an effective evidence-based list of brain breaks that teachers can offer their students.

Study 2

Method

Participants Elementary and middle school children ranging from grades 1-6 (M = 9.37 years, SD = 2.32 years) were recruited from two museums in a large urban area in the Mid-Atlantic Region of the United States. Approximately 53% of children were female, with 2% identifying as other. Parental report of race information for the sample of children was as follows: 91% White, 7% Asian, and 2% Black. Children received a small prize for their participation.

Materials The authors designed the study materials to provide a visual aid in explaining each brain break to the child. An image representing each brain break was glued onto an 8.5 inch by 4.5 inch cardboard sheet, for a total of 12 images encompassing 2 break instantiations for each of the 6 break types. The ranking portion of the task utilized a number line that was created using 2 cardboard sheets each measuring 15.5 inches by 4.5 inches, one sheet with the numbers 1-3 and one with the numbers 4-6. These sheets were arranged vertically to form a continuous number line when presented to the child.

Brain Break Preferences Questionnaire The brain break preferences questionnaire utilizes six different break types: cognitive engagement, mindfulness exercises, physical activity, nature videos, coloring, and mind wandering. Two instantiations of each break type were presented to the child. An example is provided in Figure 1.

Cognitive Engagement Break For the cognitive engagement break type, children were asked to choose between pattern blocks and a maze.

Mindfulness Break For the mindfulness exercises, children were asked to choose between belly breathing or a body scan (thinking about one body part at a time to loosen and relax each one).

Physical Activity Break For the physical activity break, children were asked to choose between color jumping (jumping into colored rings on the floor that match the announced color) and calisthenics.

Nature Video Break Children were asked to choose between two different videos of nature scenes watching a video of forest scenery or cows grazing on grass.

Coloring Break When asked about what children would prefer to color during a coloring break, children were given a choice between mandalas and abstract coloring.

Mind Wandering Break For the mind wandering break, children were asked to decide which visual focal point they preferred between an abstract poster or a poster of a starry sky.

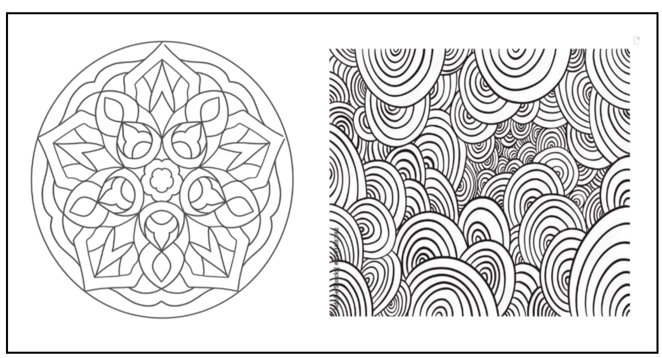

Figure 1: Two Coloring Break Instantiations, a mandala and an abstract image that fills the page.

Procedure Participants were randomly assigned to one of 4 presentation orders, which were counterbalanced for the order of the questions (i.e., presenting cognitive engagement breaks first as opposed to presenting mind wandering breaks first) as well as the order of the break instantiations provided in each question. The task consisted of two parts. In Part 1, children were given a forced-choice task where they were given two instantiations of a break type, and asked to choose which one they preferred, and which one would help them focus more when returning to their work. To help reduce the threat of social desirability, children were reminded for both questions that whichever option they chose was fine. This procedure was repeated for each of the six break types.

In Part 2, children were asked to rank the six breaks they selected in Part 1 from most to least preferred by arranging the cardboard sheets with the image of each brain break on the number line with 1 being the most preferred and 6 being the least preferred break (see Figure 2). The ranking process was then repeated with the six breaks they indicated would help them focus more from Part 1.

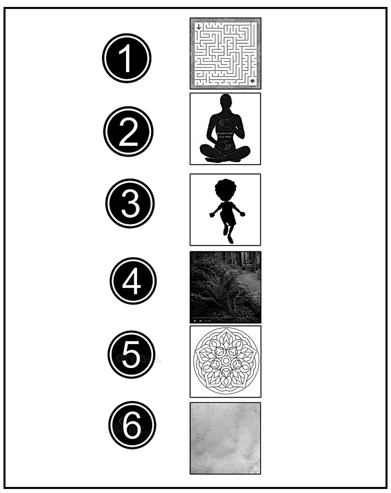

Figure 2: Example of Break Ranking Task. Images obtained from Google Images and/or created by the study authors.

Results

Children's Preference Rankings Across Break Type Initial analysis of preference across break type was conducted using a chi-squared goodness of fit test using the data collected from Part 2, where children ranked the six breaks from most to least preferred. Frequencies for each break type were calculated by adding the reported frequencies of both instantiations within that break type (for example, preference for cognitive engagement was calculated by adding the frequencies of pattern blocks and mazes that were reported as the most preferred break). The analysis revealed that cognitive engagement breaks were more likely to be ranked most preferred over all other break types, $\chi^2(5, N = 52) = 22.77$, $p < .001$, $\phi = .66$. In contrast, mindfulness exercise breaks were ranked least preferred more often than other break types, $\chi^2(5, N = 52) = 39.85$, $p < .001$, $\phi = .87$. There were no significant preferences across break type for ranks 2 through 5.

Children's Focusing Rankings Across Break Type The ranking of break types that would help the child focus more did not reveal any significant findings. The weighted mean ranks for each break type are listed in Table 1.

Table 1: Weighted Mean Rank of Each Break Type

Break Type	Preference	Focusing Ability
Cognitive Engagement	2.60	2.96
Mindfulness	4.88	3.64
Physical Activity	3.71	3.96
Nature Video	3.50	3.42
Coloring	3.17	3.53
Mind Wandering	3.13	3.49

Children's Preferences Within Break Type Initial analysis of children's preference for a particular break instantiation within each break type was conducted using a chi-squared goodness of fit test. The data revealed significant preferences for certain instantiations within a break type for both break preference and the break that would benefit their focus the most when returning to their classroom instruction.

Cognitive Engagement For the cognitive engagement break type, the maze was reported as the preferred choice compared to pattern blocks, $\chi^2(1, N = 53) = 8.32$, $p = .004$, $\phi = .40$, as well as the better activity to help children focus, $\chi^2(1, N = 53) = 7.69$, $p = .006$, $\phi = .38$.

Mindfulness There were no significant differences in students' preference between both mindfulness instantiations with regards to either general preference nor focusing ability.

Physical Activity For the physical activity break type, color jump was the preferred option over calisthenics, $\chi^2(1, N = 53) = 15.87$, $p < .001$, $\phi = .55$. There was no difference in perceived focusing ability between the physical activity break instantiations.

Nature Video In the nature video break type, the forest scenery video was the preferred option, $\chi^2(1, N = 53) = 9.98$, $p = .002$, $\phi = .43$, and was also the break instantiation reported to help children focus more, $\chi^2(1, N = 53) = 18.13$, $p < .001$, $\phi = .58$.

Coloring For the coloring break type, the mandala coloring activity was the preferred option, $\chi^2(1, N = 53) = 5.45$, $p = .020$, $\phi = .32$, as well as the preferred option for focusing ability, $\chi^2(1, N = 53) = 4.25$, $p = .039$, $\phi = .28$.

Mind Wandering With the mind wandering break type, the starry sky focal point was significantly preferred more by children than the abstract focal point, $\chi^2(1, N = 53) = 38.21$, $p < .001$, $\phi = .85$. Children also reported the starry sky poster as the preferred option for focusing ability, $\chi^2(1, N = 53) = 8.32, p = .004, \phi = .40$.

Differences Between Preference and Focusing Ability A McNemar Exact Test was conducted for each break type to compare the proportions of selected break instantiations of children's general break preference and a break's perceived benefit for focusing. In other words, are children likely to select the same break instantiation when asked about their preference as when asked about the most beneficial break to help them focus, or are children's ratings orthogonal?

The Chi-Squared Goodness of Fit Test indicated that children reported the starry sky poster as their preferred focal point and the most beneficial mind-wandering break for focusing ability. However, the McNemar Exact Test indicated that children were more likely to switch their choice to the abstract poster when asked about focusing ability. Otherwise, children generally chose the same break instantiations for both preference and focusing ability across the remaining break types. Results are provided in Table 2.

Table 2: Statistical Significance of McNemar's Exact Test By Break Type

Break Type	*p*-value
Cognitive Engagement	1.000
Mindfulness	.824
Physical Activity	.096
Nature Video	.503
Coloring	1.000
Mind Wandering	.002

Discussion

There were multiple notable findings from Study 2. First, cognitive engagement breaks were more likely to be ranked by children as the most preferred break type than any other break type. This could be due to the similarities between the break and the activities children are engaging in during class, allowing them to keep their brain active akin to warm-up exercises that have been shown to improve task performance (Karpushyna, Bloshchynskyi, Zheliaskov, Chymshyr, Kolmykova, & Tymofieieva, 2019). This is consistent with the finding that the mindfulness exercises were the least preferred break type, possibly due to the necessity of switching from engaging with instruction to a more self-directed calming activity that could perhaps cause dissonance.

In future research it may be informative to collect qualitative data in which children are queried about the reasons for their preferences. Some potential hypotheses that could be explored in future research include whether perceived challenge and reward contributed to children's brain break selections. For example, the maze was significantly more preferred as a cognitive engagement break than the pattern blocks, which could be due in part to the perceptually challenging nature of the maze exemplar and in turn perhaps a heightened feeling of a potential reward at completion. Similarly, perceptual characteristics of the exemplars, such as color and brightness, may have also contributed to children's break selection. For example, The preference of the color jump and starry sky poster in the physical activity and mind wandering break types, respectively, suggests that children may be drawn to more colorful breaks.

One goal of Study 2 was to take childrens' interests into consideration in order to identify the most preferred set of breaks that could then be tested empirically to assess how effectively they replenish children's attention in order to provide teachers with a set of research-based brain breaks that could then be implemented in classrooms. With the variety of students in each classroom, class-wide breaks are likely to benefit some students more than others. Allowing students to choose their own brain break could help advance equity by allowing for greater autonomy and individuality in classrooms. However, it is likely important to present the opportunity for choice in a manner that does not result in decision overload for example by providing students a narrower set of options from which to make their selection (Beymer & Thomson, 2015).

The use of individualized brain breaks can offer all students the opportunity to replenish their attentional capacity in order to focus during classroom instruction, and foster positive social interactions with other students and teachers. Individual brain breaks could also make it easier for teachers to offer breaks to students *as needed*, which is not possible when implementing breaks in a whole-class format. This could advance equitable practices as the usage of an individual brain break is student-centric and could be implemented in a way that improves attentional capacity at the most opportune time for each student.

General Discussion and Future Directions

The findings from Study 1 revealed several patterns in the deployment of brain breaks in U.S. classrooms. Most teachers deployed brain breaks in their classrooms in between instructional activities. The majority of teachers reported using physical activity breaks, videos, and dancing, showcasing the perceived importance of movement in their selection of brain breaks.

It is of interest that the large majority of teachers reported using whole-classroom breaks. It is currently unknown whether the whole-class format is optimal for attention replenishment due to its deindividualized nature. It is possible that individual brain breaks are more beneficial for attention and learning, as they can be administered on an as-needed basis providing opportunities for more targeted intervention. Additionally, individual brain breaks may provide students with a greater sense of autonomy as it is more feasible for students to choose their own break type in this format. Future studies can systematically examine these questions to ascertain the effects (if any) of break format (whole-classroom, small group, individual) on children's attentional capacity, motivation, and learning upon returning to an instructional activity.

The results from Study 1 also indicate that teachers reported using brain breaks in language arts more than any other subject, which leads to questions about the interaction between brain breaks and classroom subject material. It is unknown whether brain breaks are equally impactful across subject areas or if their potential effect is amplified when they are incorporated in certain subject areas that have a higher difficulty level or longer duration. Future research can also investigate whether the teachers' reported need for brain breaks in each subject area aligns with student perceptions as well as behavioral data (i.e., frequency and duration of off-task behavior).

In Study 2, we found within break types that children often had clear preferences for specific break instantiations. When presented with two separate instantiations of each break type, students preferred the maze, color jump, forest scenery, mandala coloring, and starry sky breaks for the cognitive engagement, physical activity, nature video, coloring, and mind wandering break types, respectively. It is noteworthy that when comparing break preferences *across* the different break types we found students largely preferred cognitive engagement breaks over any other break type, including physical activity breaks.

These findings are in contrast to the results from Study 1 discussed above in which many of the brain breaks that teachers reported using had a physical activity component to them. Students' preference for cognitive engagement breaks may reflect interest in keeping the brain active with a novel and presumably less demanding cognitive activity. It is also possible that this discrepancy in preferences could reflect potential grade-level differences. The children in Study 2 were older, on average (M = 9.38 years), than the grade levels teachers taught in Study 1 (K-2). It is an open question as to whether break preferences differ for younger children compared to older students, and this is an important area for future inquiry. Indeed, future research should explore whether break type preferences change across a wider range of grade levels (for both students and teachers) and if participating in the breaks as opposed to receiving a verbal description of the break instantiations would alter students' preferences. Our ongoing research is currently experimentally examining the effects of these brain breaks on student attention and retention; the results from that study are forthcoming.

The current studies aid the understanding of how brain breaks are deployed in classrooms, as well as children's preferences for different break types, which may ultimately improve the set of brain breaks offered to individual students. The findings may help guide teachers' selection of breaks to be able to offer a more tailored set of brain breaks that are more widely preferred by students. For example, teachers likely do not need to offer pattern blocks as a brain break since the maze was highly preferred, but teachers could offer both mandala and abstract coloring since there was no significant difference in students preference ratings between these two break instantiations.

Ultimately, student preference data (in combination with empirical data on break efficacy) can help guide brain break selection and reduce the number of brain breaks that teachers need to prepare, while simultaneously mitigating choice overload by reducing the number of options that students need to pick between (Beymer & Thomson, 2015). In doing so, teachers can provide students opportunities to exercise procedural autonomy and an opportunity to pick the brain break that is most suited for their attention replenishment needs.

In conclusion, the present studies aimed to survey the current landscape of brain break usage as well as compile student opinions on different brain breaks to determine if there are any clear preferences. The real-world implications of this work are paramount to improving attention replenishment for students in an engaging way without a significant reduction in classroom instruction time. The directions for future research will serve to continue the examination of this instructional strategy, its efficacy, and the factors that may influence its effectiveness and use in order to field and improve the deployment of research-based brain breaks in classrooms.

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