ABSTRACT—Advocates of the arts agree that the K-12 curriculum should include dedicated time for arts instruction. Some have argued further that knowledge and skills acquired through the arts transfer to nonarts domains. Others claim that evidence of this kind of transfer is limited and instead argue that the arts cultivate valuable dispositions that help students succeed both in and outside of school. Another potential benefit of the arts has received little attention, however. Arts integration—the use of the arts as a teaching methodology throughout the curriculum—may improve long-term retention of content. A variety of long-term memory effects well known in cognitive psychology are reviewed, and it is argued that arts integration naturally takes advantage of these effects while promoting student motivation. This review of findings and applications provides an example of how existing research from neuroscience and cognitive science can inform the work of practicing educators.

Although advocates of the arts may agree that artistic activity is valuable in itself and that students need dedicated arts classes, considerable controversy surrounds further proposals that the arts may benefit cognition more broadly. Two different types of proposals to this effect have been made: those that identify transfer of knowledge and skills to nonarts domains as the primary cognitive benefit of the arts (e.g., Gazzaniga, 2008) and those that instead emphasize the role of the arts in helping students develop valuable dispositions or habits (e.g., Hetland, Winner, Veenema, & Sheridan, 2007). The argument in favor of the “transfer of knowledge and skills” account has been made on the basis of two types of evidence. First, correlational studies indicate that students who participate in the arts tend to outperform their peers on standard measures of academic achievement (Fiske, 1999). Second, certain forms of artistic practice have been linked to improvement of cognitive capacities thought to be important for academics, for example, research suggests that musical training can improve spatiotemporal reasoning, and this may help with certain forms of mathematics learning (Vaughn, 2000). Another example is the claim by Posner and Patonce (2009) that arts training benefits general cognition (as measured by intelligence quotient [IQ]), perhaps through improvement of executive attention. In contrast, supporters of the alternative “cultivation of dispositions” view argue that the transfer of knowledge or skills from the arts to nonarts domains may be rare and that transfer does not represent the primary benefit of artistic activity (Hetland & Winner, 2004). Hetland and colleagues instead hold that what students gain through engagement in the arts are dispositions—such as persistence and reflectiveness—that help them to be successful in many pursuits, including academics.

Both of the arguments described earlier have been cited in support of “arts integration”—colloquially described as “teaching through the arts,” although a wide variety of conceptualizations have been offered (for a review, see Burnaford, Brown, Doherty, & McLaughlin, 2007). In this article, we argue that regardless of one’s definition, arts integration may support learning in a manner that has received little attention to date—namely, utilizing artistic activities for instruction in other content areas may be a particularly effective means of enhancing long-term retention of content, an idea previously suggested by Hardiman (2003, 2010). Building on this idea, we propose here that arts integration leverages a number of different factors whose positive effects on long-term memory are well documented. While the effects of many of these factors have been known to cognitive psychologists for 20–30 years or more, they remain the subject of ongoing research. These various effects will be reviewed one by one, and in each case it will be shown how the causal antecedents of the effect are naturally incorporated into...
one or more forms of artistic activity. Eight different kinds of effects will be considered in all. These include effects of (a) rehearsal, (b) elaboration, (c) generation, (d) enactment, (e) oral production, (f) effort after meaning, (g) emotional arousal, and (h) pictorial representation.

**REHEARSAL**

We begin with a factor whose effect on long-term retention might seem relatively intuitive—repeated rehearsal of information. Rundus (1971) conducted seminal research on how rehearsal of verbal information affects subsequent recall of that information. In a series of experiments, participants were presented with sequences of words and rehearsed them aloud; the number of rehearsals was observed to be directly related to the probability of subsequent recall. This effect of rehearsal is enhanced by introducing space between rehearsals. Rundus showed that when a given item was presented a second time after a delay, the probability of recall increased as a function of the “lag” or “space” between the repetitions.

Although early work by Rundus (1971) and others clearly showed that repeated, spaced rehearsals of verbal information can improve recall, subsequent research by Craik and Watkins (1973) showed that the effect of rehearsal does not seem to derive simply from the number of times an item of information is rehearsed. For rehearsal to be effective, it needs to be “elaborative.” That is, pieces of information need through the process of rehearsal to become in some way tied to one another, to other available information, or to prior knowledge. Through experiments that dissociated “elaborative” rehearsal from “maintenance” rehearsal, it was shown that only the former—rehearsal that establishes a more elaborate memory trace—improves long-term retention. Additional research of note includes the finding that spontaneous use of rehearsal strategies does not appear to develop before the age of 8–10 (Naus & Ornstein, 1983), although younger children can be instructed to use rehearsal strategies in order to improve recall (Naus, Ornstein, & Aivano, 1977). Recently, it has also been shown that nonverbal forms of rehearsal can improve recall for visual stimuli such as abstract symbols (Hourihan, Ozubko, & MacLeod, 2009). Finally, work in cognitive neuroscience has corroborated the impact of rehearsal by identifying neural markers of rehearsal that predict later recall of information (Davachi, Maril, & Wagner, 2001).

As with all the memory effects to be reviewed in this article, it is very possible to apply what is known about elaborative rehearsal to instructional practice through means other than arts integration. That is, a teacher might increase retention simply by having students rehearse information on repeated occasions spaced over time. However, artistic activity may offer a more effective way to prompt elaborative rehearsal, as students will likely be more motivated to engage in artistic activities than to simply repeat after the teacher. Smithrim and Upitis (2005) report that arts integration increases students’ motivation to learn, and Posner and Patoine (2009) suggest that artistic activity is quite unique in its ability to motivate sustained attention. So ultimately, while rehearsal certainly could be prompted by other means, we argue that arts integration methods are particularly useful because they engage students in rehearsal naturally in a way that is at once both motivating and effective. As will be seen throughout this article, a core strength of arts integration as a pedagogical method lies in its affordance of opportunities to strengthen long-term memory for instructional content.

To illustrate, consider a teacher whose objective is to help students retain information from a lesson on a historical event, say George Washington’s famous crossing of the Delaware. The teacher could potentially help students create an elaborate memory trace simply by asking them from time to time to recite pieces of information in association with one another (e.g., the crossing took place during the American Revolution on December 25, 1776; it instigated the Battle of Trenton; the attack caught the enemy Hessian troopers by surprise). Alternatively, however, one could engage students in arts-integrated activities—such as drawing pictures or creating other kinds of nonverbal representations of the information to be remembered. Or, instead of simply having students recite information aloud, one could put the material to music and have students sing a song that incorporates relevant subject matter. This would likely make subsequent rehearsals more fun and less tedious. The common sense of Sesame Street and advertising jingles alike illustrates how putting information to music promotes repeated rehearsal by making it more enjoyable—often to the point that rehearsal occurs spontaneously (think of that catchy tune you just cannot get out of your head). Many teachers already use activities of the sort described here; we aim simply to provide an explanation of their effectiveness and suggest that they be used as part of a broader system of arts-integrated instruction. Arts integration naturally provides opportunities to embed repeated, spaced rehearsals into activities in ways that make rehearsal easier, more effective, and more fun.

**ELABORATION**

The previous section noted the way in which rehearsal can serve to help create a more “elaborate” memory trace. However, considerable research has also shown that semantic elaboration—elaboration that adds meaning—can improve retention of information. Anderson and Reder (1979) argue that “depth of processing,” a factor known to improve memory (e.g., Craik & Tulving, 1975), essentially reflects an increase in the quantity and richness of semantic elaborations on information. Providing further empirical support for this
view, Reder (1979) showed that prompting participants to draw elaborative inferences while they read stories led to faster response latencies for correct answers on a subsequent memory assessment. Moreover, Klein and Kihlstrom (1986) has shown that retention is particularly strong when individuals elaboratively relate information to themselves in some way.

A wide variety of artistic activities seem to naturally involve the kind of elaboration that is likely to improve subsequent recall of material. Activities in which students are asked to write stories that incorporate information to be remembered will naturally lead to elaboration on the information provided. So, too, it seems that writing a poem or song or creating a work of visual art may often require students to elaborate and create a background context that would be absent if information were considered in isolation. The process of creating a surrounding context contributes to the establishment of a more elaborate memory trace. In addition, as Klein and Kihlstrom (1986) point out, a person’s representation of his or her “self” is perhaps one of the most elaborate structures in anyone’s memory; thus, there may be an added benefit to having students create works of art that explicitly relate subject matter to themselves. For example, when teaching about Washington crossing the Delaware, students might be asked to write stories or letters from a first person’s point of view, imagining themselves to be part of Washington’s army, or perhaps one of the surprised Hessian troops. Compared to conventional activities such as reading, writing reports, or completing worksheets, such artistic activities are sure to be more engaging, and will tend to promote better long-term retention of material.

**GENERATION**

Another well-known effect on memory for information is the “generation effect”—the finding that generating information in response to a cue leads to better retention than does simply reading that information. Slamecka and Graf (1978) offer one of the most well-known demonstrations of this effect. Participants either read words or “generated” them in response to stimulus words and cues that helped them generate the proper word. Results showed that recall was better when words were generated rather than read. A wide variety of explanations for the generation effect have been offered (for a recent review, see Bertsch, Pesta, Wiscott, & McDaniel, 2007). These include, among others, explanations based on depth of processing (Kane & Anderson, 1978), cognitive effort (Tyler, Hertel, McCallum, & Ellis, 1979), transfer-appropriate processing (Crutcher & Healy, 1989), and relative distinctiveness (Peynircioğlu & Mungan, 1993).

A particularly intriguing account of the generation effect is offered by Nairne, Riegler, and Serra (1991), who suggest that the effect may arise due to a trade-off between memory for individual items and memory for the serial order in which they are presented. Following up on this idea, McDaniel and Bugg (2008) argue that information that has been generated is more “unusual” (i.e., encountered less frequently) than information that has been read. This unusualness leads to greater processing and better memory for individual items but disrupts memory for order information that could also be used during recall. This account can explain why the generation effect, like a number of other memory effects, often disappears or reverses when control items are read in isolation in “pure” lists (rather than being intermixed) and memory is tested through free recall. Presenting common, read items in “pure” lists aids memory for the serial order in which items are presented, and the use of this order information may improve free recall as much as or more than generation or similar factors. Because the account of McDaniel and Bugg offers a unified explanation for a wide variety of findings related to multiple memory phenomena, attributing memory effects to unusualness is an especially attractive option.

Regardless of what causes the generation effect, knowledge that generation of information improves recall would clearly be useful to teachers in a classroom setting. When possible, teachers might engage students in activities through which they generate information instead of simply receiving it in written or oral form. It is useful to note here that the generation effect may not be limited to verbal information; Kinjo and Snodgrass (2000) also found a generation effect for pictures. Returning to the lesson on Washington’s crossing of the Delaware, it is possible to see how creating a work of art provides an opportunity for students to generate information they might otherwise simply receive. Suppose students are given minimal details of the event, perhaps just the date and time of the crossing and its purpose, and are then asked to write a story describing how the crossing and ensuing battle may have transpired. To create a meaningful story, a student would need to draw inferences from the information received. From the knowledge that the crossing took place on the night of December 23, 1776, the student may naturally generate the information that this was Christmas night, that it was likely very cold outside, that the soldiers had to travel by boat in potentially treacherous conditions, and that the attack may, as a result, have taken the enemy troops by surprise. If, through artistic activities like writing a story or creating a drawing, students generate information they might otherwise have simply read, this will very likely lead to better long-term retention of that information, something anyone would agree is critical for academic achievement.

**ENACTMENT**

The “enactment effect” refers to the finding that physically acting out material leads to improved recall relative to simply
reading or hearing material. For example, Mohr, Engelkamp, and Zimmer (1989) found that recall of action phrases was better when participants in their experiments actually performed the actions described. This improvement in recall was attributed to the fact that information was subject to motor encoding in addition to verbal encoding.

It has also been suggested, however, that the mnemonic benefits of enactment do not derive from spontaneous retrieval of motoric information, as originally believed. McDaniel and Bugg (2008) argue that the enactment effect, like the generation effect, can be explained in terms of the unusualness of enacted information and the greater processing this engenders. Senkfor, Van Petten, and Kutas (2008) similarly point to additional processing at the time of encoding as the likely cause of the enactment effect. This additional processing, they argue, is no different in kind from that which occurs for stimuli that lead to “conceptual” encoding rather than motor encoding. In support of this view, Senkfor et al. conducted an experiment in which participants either performed an action on an object, leading to motor encoding, or estimated the cost of the object, leading to conceptual encoding. Results showed that while enactment did cause participants to have better “source” memory—that is, memory for whether they had previously performed an action or estimated the cost of the object—recognition accuracy did not differ across encoding conditions. Event-related potential (ERP) data collected at test time corroborated this result; electrical activity did not differ depending on the means of encoding for the recognition test, but did differ for the source test. It is worthwhile to note that if conceptual encoding makes information unusual, the account in terms of unusualness offered by McDaniel and Bugg can explain the similarity between effects of enactment and conceptual encoding found by Senkfor and colleagues.

The obvious intersection of enactment effects and arts integration lies in the performing arts, and in particular, theater. In fact, this is one area in which benefits of arts integration for memory have already been described. Podlozny (2000) conducted a meta-analysis of studies on the use of drama in the classroom, noting that one of the greatest benefits is its effect on the recall of stories. Many teachers may already incorporate drama into their instruction related to literary works, perhaps because drama activities are seen as fun. However, teachers should also be aware (if they are not already) of the retention benefits that acting out material produces over simple reading or listening. It is surely true that not all literary material lends itself to enactment as described here. However, in keeping with a broad arts-integrated approach to instruction, teachers would be wise to couple reading of novels, stories, or poems with enactment of key segments. Just consider, for instance, how much more memorable Ernest Thayer’s poem “Casey at the Bat” might be if students themselves were to enact poor Casey’s monumentally disappointing swing and miss at the plate.

ORAL PRODUCTION

One very recently discovered effect that fits nicely with those described already is the so-called production effect (MacLeod, Gopie, Hourihan, Neary, & Ozubko, 2010), the finding that “producing” a word orally leads to better subsequent recall than does reading the word silently. In a variety of experiments, MacLeod et al. showed that the production effect was observed when some subset of presented words were either spoken aloud or “mouthed” without vocalization, but was not observed when participants made the same overt response (e.g., saying “yes”) to all the words in a selected subset. Ozubko and MacLeod (2010) argue that memory is improved because oral production makes pieces of information distinctive relative to surrounding items that are only read. Here too, however, it seems that oral production could potentially confer unusualness of the sort described by McDaniel and Bugg (2008), and this, instead of relative distinctiveness, could account for the effect observed.

Finding ways to take advantage of the production effect via arts integration is a relatively straightforward task; when students sing songs or engage in theatrical performances that include information to be remembered, they will produce that information orally, promoting retention. At this point, it is important to note a caveat regarding any attempt to leverage the production effect—or the generation and enactment effects—through arts integration. If it is indeed the case that the account offered by McDaniel and Bugg (2008) explains all these effects, and greater retention derives from the unusualness of information that has selectively been treated differently, it is important to only include target information in arts-integrated activities. The unusualness of information is precisely what allows one to recall a given piece of information and/or discriminate it from other pieces of information. To enhance a student’s ability to, for example, recognize a correct answer among foils on a multiple choice test, it is necessary that those foils seem less unusual than the correct answer. For instance, imagine that one had put the names of the eight planets to a melody in an effort to aid students’ retention. One might be tempted to include in this song the fact that Pluto is not a planet, because of its recent demotion by astronomers (Coven, 2006). If some time later, however, a student needed to distinguish planets from nonplanets on a test, and the song itself had been forgotten, Pluto would likely seem just as unusual as Mars, Jupiter, and the rest of the planets. This would make it more difficult to rule out the incorrect response. This example shows the importance of using arts integration selectively and thoughtfully when designing lessons.

EFFORT AFTER MEANING

The phrase “effort after meaning,” coined by famed British psychologist Frederic Bartlett (1932), refers to the effort
exerted to understand novel information. Although Auble and Franks (1978) do not explicitly refer to Bartlett’s work, they do investigate how a nearly identical notion—“effort toward comprehension”—affects subsequent recall of information. In a series of experiments, Auble and Franks presented participants with relatively incomprehensible sentences (e.g., “The notes were sour because the seam split”), along with cues that helped to disambiguate those statements (e.g., “bagpipe”). In one condition, the cue was simply presented along with the ambiguous sentence. In two other conditions, participants either received the cue and were given time to elaborate on the information presented or received the cue after a delay of equivalent duration. Results showed that recall of sentences was best when the cue was presented after a delay, leading participants to briefly puzzle over the meaning of the sentence (exert effort after meaning). Auble and Franks concluded that the effect of effort toward comprehension is distinct from and greater than that of elaboration. Subsequent work by Auble, Franks, and Soraci (1979) suggested that the effect of effort toward comprehension may derive from the production of an “aha!” reaction following a delayed receipt of the cue.

More recently, however, Zaromb and Roediger (2009) have argued in a manner similar to McDaniel and Bugg (2008) that the memory advantage attributed to effort after meaning may instead arise for the same reason as the generation, enactment, and perhaps production effects—exerting unique effort to understand target material may be a relatively unusual occurrence, and this may lead to additional processing of information. One final note about effort after meaning is that, interestingly, Zaromb, Karpicke, and Roediger (2010) found that individuals have essentially no metacognitive awareness of any resulting gains in retention of information. This means that effort after meaning is unlikely to take place as part of any spontaneous, conscious attempt to commit material to memory.

The fact that learners are generally not aware that their efforts after meaning will lead to better retention means that some motivation other than an explicit learning goal is likely needed for individuals to exert this kind of effort. Here again, the motivating character of artistic activity can play an important role. The enjoyment of art is in many ways dependent upon its interpretation by the observer; in order to appreciate art on an aesthetic level, it must be comprehended in a way that gives it meaning. The pursuit of aesthetic experience provides a natural motivation for exerting effort after meaning. This makes art a useful vehicle for educational content. If material is embedded in a painting, poem, or some other form of art that requires interpretation or “decoding” by the observer, students will naturally reap the retention benefits of coming to understand that material through the process of interpretation—a process that students may be naturally inclined to engage in as they seek to appreciate art aesthetically. Consider, for instance, the information that a student might extract through the interpretation of art that functions as social commentary—perhaps Picasso’s Guernica or even Andy Warhol’s Campbell’s Soup Cans. If the act of interpretation leads a student to understand the toll the Spanish Civil War took on the civilian population or to recognize the explosion of commercialism in American culture during the 1950s, those ideas will almost certainly stick in the student’s memory better than they would if they were simply read from a textbook.

EMOTIONAL AROUSAL

It has long been recognized that high levels of emotional arousal can impact memory for information in important ways. Brown and Kulik’s (1977) famous description of “flashbulb memories”—for example, near-perfect recall of the setting in which one heard that John F. Kennedy had been assassinated—is perhaps the most oft-cited example of how memory is improved when emotions run high. However, research has also shown that emotions (either positive or negative) can influence long-term declarative memory in more subtle and commonplace ways (Kensinger & Schacter, 2008). Of particular interest here is evidence that in general, information that is more emotionally arousing is better remembered than that which is emotionally neutral. Cahill and McGaugh (1995) conducted experiments in which participants read stories that were closely matched, but differed with respect to how “emotionally arousing” a certain segment was. Results showed that after a delay, memory for the more emotionally arousing segment was indeed better. This finding and others like it form the basis of the broader concept of “emotional enhancement” of long-term memory.

There may be multiple factors involved in emotional enhancement of memory. Foremost, McGaugh (2004) has advanced the notion that the amygdala, commonly associated with emotion, also plays an important role in the memory consolidation process. Specifically, levels of activation in the amygdala during memory encoding have been shown to be strongly related to subsequent recall of emotionally arousing information. Emotional arousal may also modulate attention, producing indirect effects on memory (Talmi, Anderson, Riggs, Caplan, & Moscovitch, 2008). That is, there is evidence that emotional arousal leads to changes in attentional focus during encoding; in addition to aiding immediate recall of information, this indirect effect may likewise lead to greater long-term memorability.

Because art often involves emotional expression, it seems quite plausible that teaching through artistic activities could aid recall by way of emotional arousal. One way to take advantage of this would be to incorporate information that readily elicits some kind of emotional response into artistic activities that promote expression of emotional content. For example,
when students read literary works in class, memory for content may be enhanced by prompting students to express the emotions of characters in the story—perhaps in the form of drawings or paintings, creative writing projects, or even theatrical performance or dance. Imagine the effect that these kinds of activities might have for commonly read stories like “To Build a Fire” by Jack London, the tale of a man and his dog traveling by foot through the Yukon in subzero temperatures. Expressing the feelings of the man—or even his dog—through a creative writing assignment may very well do much more to imprint the story on a student’s memory than would the average fill-in-the-blank worksheet, for example. By supplanting some conventional activities with artful work that promotes expression of emotional content, teachers can readily leverage what is known about emotional enhancement of memory.

PICTORIAL REPRESENTATION

The final effect to be reviewed is commonly known as the “picture superiority effect.” It has been found in numerous studies (e.g., Shepard, 1967) that information presented in the form of pictures is retained better than information presented in the form of words, even when tests are verbal in nature. The most well-known explanation of the picture superiority effect is Paivio’s (1971) “dual-code” theory, in which it is argued that memory for pictures is superior because pictures are encoded both visually and verbally, while words are encoded only verbally. This double encoding is thought to make pictures easier to recall. More recently, however, others have argued that the idea of transfer-appropriate processing can explain the picture superiority effect. An example is the work by McBrine and Dosher (2002), who argue that pictures are in general processed more conceptually than are words. In most studies comparing memory for pictures versus words, tasks require conceptual processing (e.g., free recall or semantic categorization), and therefore, pictures are recalled better than words. However, when tasks at recall require less conceptual processing (e.g., word-stem or picture completion), there is evidence that recall is better when study and test formats match (i.e., studying pictures is better for picture completion and studying words is better for word-stem completion). Finally, it should also be noted that Defeyter, Russo, and McPartlin (2009) have found that the picture superiority effect is not evident in very young children (7 or younger) and develops over time, becoming larger and larger until adulthood. Defeyter et al. argue that the picture superiority effect may depend upon the emergence of a capacity for recollection as opposed to mere judgment of the familiarity of stimuli.

The implications of the picture superiority effect are quite clear; when images can efficiently and meaningfully convey the same information as words, the use of images will likely lead to better retention (at least for older children and adults). In most cases, the choice is not either-or—that is, images can be used to supplement information presented verbally. Using images that have artistic content may be a good way to present information in pictorial form. To return one final time to the lesson about George Washington crossing the Delaware, research on the picture superiority effect indicates that any teacher would be remiss if he or she failed to include in the lesson Emmanuel Gottlieb Leutze’s iconic 1851 painting of this historical event. The impression left upon students by this work of art will likely not be soon forgotten, and this can only serve to benefit students’ retention of core knowledge about the event.

CONCLUSION

The review of long-term memory effects provided in this article clearly suggests that arts integration may offer a highly effective way to enhance retention of content. While teachers can (and should) take advantage of what is known about the effects discussed here in any way they know how, arts integration naturally incorporates activities that are likely to bring about potential benefits for long-term memory. The general recommendation that teachers “integrate the arts” into everyday instruction, previously suggested by Hardiman (2003, 2010), among others, represents a useful heuristic that any teacher can keep in mind when planning lessons. Hardiman’s Brain-Targeted Teaching Model is a pedagogical model built upon the idea that arts integration can serve as a powerful tool for helping teachers translate findings from neuroscience and cognitive science into instructional practice. One component of the model emphasizes teaching for mastery of skills, content, and concepts; this provides a backdrop for interpreting and applying to practice memory research of the sort reviewed in this article. Mastery requires long-term retention of information, and as seen here, arts integration can help teachers work toward this goal.

Ultimately, it is hoped that this article will not only help convince educators to integrate the arts into classroom activities and curricula but will also provide an example for how to construct and justify teaching practices on the basis of solid, empirical research from neuroscience and cognitive science. In addition, the work undertaken here is at a minimum suggestive of the possibility that there is a wealth of scientific knowledge already in existence that can inform educational policy and practice. This underscores the importance of ensuring that researchers and educators alike are constantly making an effort to seek out such knowledge and apply it in sensible, meaningful, and measured ways for the benefit of all students.

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Arts Integration Improves Long-Term Retention


