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Bringing imagination back to the classroom: A model for creative arts in economics

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ABSTRACT

This paper draws from the cognitive and neuroscience literature to develop theoretical support for the use of creative arts in college economics classrooms. The research suggests that creative arts activate important neurological pathways that aid the transfer of information from short- to long-term memory, where it can be retrieved for future problem-solving. To encourage meaningful learning and economic literacy, students must be able to mentally organize and retain information from their classroom experiences. The fresh metaphors and imagery present in creative arts such as poetry can deepen and clarify conceptual meaning, and allow students to learn and express their understanding of economics in a more personal and memorable way.

Why I am an Economist
Because e-quil-i-bri-um is the perfect end to Haiku
Because time slows to a discount rate
at the asymptote of an hour glass
Because I am color blind to shades of gray
Because I like to tell bedtime stories to a captive audience
Because marginal costs are like shooting stars

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when it counts
Because there are exactly seven colors in a rainbow
Because self interest is like a cockroach
Because there is always a right question to the wrong answer
Because my worry lines give me away
Because I approach the limit of creativity but never reach it
Because a rational mind needs a pillow
Because the market for astronauts is too small
Because numbers are like words and functions are like stanzas
Because efficiency is the pay dirt of a lazy mind
Because a fortune cookie told me to 'be practical'
and so did my advisor.[1]

1. Background

Recent advances in cognitive psychology and neuroscience have greatly improved our understanding of how the human mind processes and retains information, leading to both theoretical and practical applications in the fields of education and cognitive psychology. At the same time, economist have become increasingly aware of the need for alternatives to the standard 'chalk and talk' approach to teaching economics, especially as it relates to principles courses (Becker et al., 2006). And yet, economists have largely failed to draw upon these scientific advances in learning to better adapt economics instruction to fit the needs of the modern day student (Watts and Becker, 2008). Particularly lacking is an understanding of the mnemonic potential of language to improve retention and learning (Gardner, 2011). Tinari and Khandke (2000) describe this failed connection as it relates to music, noting that 'despite overwhelming evidence that music has significant effects on cognitive processes, economists have generally not tapped into the use of music as a potential source for examples and applications in economics courses' (253). Although the lack of applied translational efforts to link cognitive psychology and neuroscience to pedagogical innovation is not unique to economics (Roediger, 2013), economists rely more heavily than other disciplines on lecture as the dominant instruction tool and have been slow to adapt over time (Watts and Becker, 2008).

A relatively small number of economists have advocated to varying degrees for pedagogical integration of the creative arts into economics classrooms, from the use of literary passages as case studies to the creation of student poetry and visual art to enhance depth of experience with the material. Although largely anecdotal, the available evidence is uniformly positive in student- and instructor-related outcomes. However, the existing literature lacks a defined theoretical basis to understand the mechanism behind these anecdotal successes. This paper seeks to fill this gap by drawing from the cognitive and neuroscience literature to understand potential pathways for the creative arts to impact memory and learning in economics.

Before reviewing the available literature and describing a theoretical model, it is useful to first consider the goals of economics instruction at the university level. What type of learning is expected of our students? This paper will assume that the underlying goal is to improve economic literacy, and to promote independent economic-based logic and problem-solving. The majority of college students will only be exposed to economics through the principles courses, and for this reason these goals are particularly relevant to the introductory sequences. In essence, we seek to train students (sometimes in as brief a period as a semester) to think like an economist. However, thinking like an economist in the real-world means that students must be able to adapt their knowledge to novel settings, which undoubtedly require a certain level of analytical imagination and conceptual creativity. To be sure, all of this assumes that the students' experience in the classroom was memorable enough to support retention of the basic problem-solving skills and concepts in the first place.

If we assume then that economic literacy in the real-world requires both creative thinking and a memory of the original concepts, it would make sense that these skills should be encouraged and

[1] Author Mary Davis, theme inspired by 'Why I Write Poetry' by Major Jackson, Ploughshares 2013.

valued at the point of origin – the classroom. 'In addition to highly specialized mathematical, statistical, and econometric techniques, the economist's toolbox needs to include interdisciplinary approaches to provide better, sharper, and more powerful tools to dissect, and repair society's most pressing economic problems' (Kish-Goodling, 1993, p. 339). With that goal in mind, this paper will explore the fundamental science linking creative arts to economic literacy and learning.

2. Support for creative arts in economics

The argument for more active styles of teaching and engagement in the college economics classroom is not new to the discipline (Becker, 2000). These appeals run complementary to efforts to promote economic literacy, especially as it relates to university principles courses (Hansen et al., 2002). Many suggest that the style of economics instruction with its focus on teaching through lecture and memorization fails to engender literacy and to promote general interest in the field (Hansen et al., 2002). Although few economists have carefully studied the relationship between the creative arts and economics, many have opined that their common features merit more attention in pedagogy (Watts and Smith, 1989). Becker et al. (2006) go so far as to describe the use of the creative arts in teaching, such as examples drawn from literature and film, as 'an all-too-rare instance of a feasible Pareto improvement' (15). The argument in support of creative arts integration is that they neither sacrifice rigor nor replace important economic theories in the classroom, but instead support a deeper understanding of the concepts (Becker et al., 2006). The mnemonic potential of imagery, rhyme, and repetition to enhance memory and recall of the economic concepts has been largely ignored.

Table 1 summarizes contemporary examples from the economics literature on the application of various creative arts tools in the college economics classroom (for a comprehensive review of earlier works, see Bohanon and Vachris (2012)). These publications provide course information, reading lists, and in some cases syllabi to aid others interested in replicating their efforts. Together they illustrate a number of possible strategies for integrating the creative arts, particularly in economics principles courses. Some describe the use of creative arts to generate discussion, and to explore concepts in greater depth and through various lenses, including introducing particular authors, such as Dr. Seuss (Miller and Watts, 2011) and Shakespeare (Kish-Goodling, 1993), as well as particular genres or

Table 1
Examples of creative arts integration in college economics classrooms.

Type	Authors	Application to the economics classroom
General literature	Watts (2003), Bohanon and Vachris (2012)	Comprehensive reading list of literary texts with excerpts and commentary relating it to economics
Historical novels	Cotti and Johnson (2012), Considine (2006)	Discusses the use of historical novels to teach economics
The Great Books	Hartley (2001)	Readings, discussions, written assignments, and exams relating the Great Books to introductory economic concepts
American Novels	Vachris and Bohanon (2012)	Describes use of a series of American novels to teach labor market economics
Short stories	Ruder (2006)	Readings, discussions, written assignments, and exams relating modern short stories to introductory economic concepts
Children's books	Miller and Watts (2011), Dighe (2007)	Readings and discussions relating Dr. Seuss books/passages and Wizard of Oz to economic concepts
Haiku poetry	Ziliak (2009), Bohanon (2012)	Writing and reading haiku related to economic concepts
Shakespeare	Kish-Goodling (1993)	Readings, discussions, written assignments, and exams relating *The Merchant of Venice* to monetary economics
Music	Tinari and Khandke (2000), Laswon et al. (2008)	Essay projects and reference list relating song lyrics to introductory economics concepts
General art	Watts and Christopher (2012)	Viewings and discussions relating visual art themes to introductory economic concepts

artistic mediums, such as music (Tinari and Khandke, 2000), poetry (Bohanon, 2012; Ziliak, 2009), and historical novels (Cotti and Johnson, 2012). Their application in the classroom range from extra credit options to intensive writing assignments and exams. For the more comprehensively integrated classroom, creative arts span the entire class syllabi, such as incorporating the Great Books (Hartley, 2001) or short stories (Ruder, 2006) to draw unique focus on economic concepts and logic. While the majority of these references focus on interpreting existing creative works within the context of economics, a few go so far as to encourage students to generate their own creative work, including poetry (Becker et al., 2006; Bohanon, 2012; Ziliak, 2009). In addition to the more traditional linkages to literature, music, drama, and art noted in Table 1, there is a growing literature applying pop-culture from cinema (Leet and Houserv, 2003; Mateer and Herman, 2008; Sexton, 2006), television (Considine, 2006; Jall, 2005; Kuester et al., 2014; Luccasen and Thomas, 2010; Mateer et al., 2011), and internet-based cartoons (Engel et al., 2014) to the economics classroom.

While concrete evidence on the benefit to students in terms of assessed learning outcomes is lacking, the available literature is suggestive that creative arts may provide a number of important benefits: (1) it is a more memorable experience for students (and instructors), (2) it engages students, especially otherwise disinterested ones, and (3) it facilitates economic literacy. Firstly, the anecdotal evidence from classroom experiences support the concept that economics material is made 'more memorable' by the use of literary and artistic tools (Tinari and Khandke, 2000). For example, in describing their application of Dr. Seuss children's books in the economics classroom, Miller and Watts (2011) argue that 'a central point in favor of using literary passages is simply the more memorable, accessible, and eloquent use of language than what most readers associate with economists' writing and in particular with writing in economics textbooks and journal articles' (164). Vachris and Bohanon (2012) suggest that retention is greater when the material is delivered alongside memorable and captivating stories. Hartley (2001) provides additional support for this in his use of the Great Books of Western Civilization to teach economic principles, noting that when paired with literature, 'students develop a habit of thinking about material rather than simply memorizing it' (156).

Another common theme of support among instructors who have engaged in creative arts teaching is that it engages an otherwise disenfranchised group of students. Becker et al. (2006) states, 'Although literature, drama, music, and poetry might seem out of place in economics classrooms, these are perhaps more effective than any other sources at capturing the attention of those students who claim to enjoy economics the least' (86). Watts and Christopher (2012) promote the use of visual arts in the economics classroom, noting that while formal evidence of the benefits are lacking, at a minimum the creative arts represent 'another way to water what many current and former students view as a very dry field' (420). Ruder (2006) provides a similar argument for the use of short stories in economic principles courses, noting that they help convey economic concepts in a more engaging manner. Ruder suggests that the key to the use of short stories is that they apply real-world examples and teach 'by parable.' Leet and Houserv (2003) make similar observations for the use of film, which they argue reach a target audience outside the norm.

A third central theme from the literature describing the use of creative arts in economics notes that these approaches promote and favor logic and literacy over the rote memorization practiced in more mainstream classrooms. Kish-Goodling (1993) brings attention to the goals of creative arts integration in his advocacy for Shakespeare in the classroom, 'Often literary works reflect our economic life more accurately than today's economic statistical techniques and mathematical models' (330). Vachris and Bohanon (2012) suggest that learning is improved with the increased variety of examples, a point further emphasized by Miller and Watts (2011) who argue that the Dr. Seuss children's books widen the range of possible teaching tools, ultimately improving literacy.

3. How the mind works

To understand the theoretical basis for how creative arts might improve learning outcomes in economics, it is important to first review the basic terminology of learning and memory (see also Table 2). Working memory represents the conscious cognitive center of the human mind, but it is limited in the number of *new* elements (possibly no more than two or three) that it can process at any given time (Paas et al., 2003). The concept is related to that of short-term memory, which refers to the

Table 2
Definitions of memory.

Term	Definition
Working memory	Immediate processing center of human thought; limited capacity
Short-term memory	Temporary storage of immediate stimuli or new information; limited capacity
Long-term memory	Indefinite and unlimited information storage center
Schema	Organized patterns of information stored and retrieved from long-term memory to facilitate processing and interpretation of stimuli in working memory
Consolidation	Transfer of information from short- to long-term memory

temporary storage of information just received (generally for a period up to about 20 s) (Hardiman, 2012). This limitation for processing new information is counter balanced by the ability of working memory to pull from long-term memory storage, essentially to use old information to help process new information.

Unlike short-term memory, information stored in long-term memory is thought to contain a potentially unlimited number of schema, or constructs of information organized as a single element with a specific function (Artino, 2008). Schema allow the mind to make interpretive short-cuts, collapsing necessary information about a multi-step task or mental process into a single component, bypassing the limited capacity of working memory to support complex human thought (Paas et al., 2003). Schema are synonymous with the concept of heuristics or 'rules of thumb' as they are generally understood in the experimental economics literature, and therefore are subject to the same limitations of stereotypes and bias (Tversky and Kahneman, 1974).

Short-term memory storage and working memory capacity can support complex human thought only to the extent that the necessary schema can be retrieved and processed from long-term memory. In other words, new information is more easily processed in working memory in the presence of a well-developed knowledge structure. For this reason, the critical objective of teaching and learning is to transfer the information into long-term memory, a process also known as consolidation (Hardiman, 2012). Consolidation to long-term memory allows this information to be incorporated into new or existing schema, making it available for later retrieval and application to new problems and thought processes. Fig. 1 provides a simplified flowchart of how the mind processes information.

The capacity of working memory and short term storage is extremely limited (Paas et al., 2003), and learning is unlikely to occur in scenarios that exceed the capacity of working memory. The critical component to complex learning therefore relies on the ability of working memory to harness

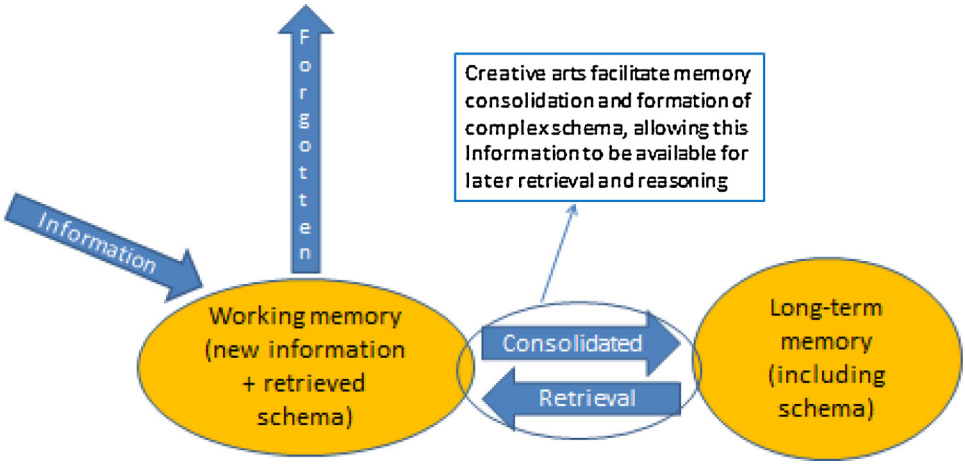

Fig. 1. Basic flowchart of information processing in memory.

information from long-term storage through available schema. Although working memory provides the processing center for consciousness, without the schema present in long-term memory we would not be capable of intellectual activity, much less complicated economic reasoning.

Recent work in brain imagining provides additional insight into how the creative arts might impact and improve learning (Ferstl et al., 2008; Schon et al., 2010; Zeman et al., 2013). While it is commonly understood that the left hemisphere of the brain is responsible for the lion's share of language processing (Binder et al., 1997), a growing body of research indicates an important role for the right hemisphere in processing more emotional forms of language, including music, poetry, and figurative language. Zeman et al. (2013) compare poetry versus prose (such as textbook passages) using fMRI to identify differential patterns of brain activity in response to the varied language format. Their results suggest that right hemisphere processing, and particularly those areas previously associated with introspection and deeper meaning, are differentially activated in response to poetry over prose. This work follows a growing body of neuroimaging research exploring how our brains process complex language such as metaphors (Ferstl et al., 2008) and song (Schon et al., 2010). Based on this preliminary work, poetry and music appear to have very particular brain responses, and activate areas outside the standard reading network that would be derived from traditional textbook learning to stimulate areas involved in complex reasoning.

So how does this all relate to learning, and specifically to creative arts in economics pedagogy? The goal of economic literacy is only feasible if students are able to transfer instructional material from short- to long-term memory through this process of consolidation. Economic literacy requires that students develop the appropriate schema, so that this logic might be retrieved for later problem-solving. The creative arts enhance learning by supporting the consolidation of learned information into an organized framework to promote memory acquisition, retrieval, and literacy.

3.1. Cognitive load theory

Cognitive load theory (CLT) represents a theoretical construct to understand how working memory supports or impedes learning (Artino, 2008; van Merrienboer and Sweller, 2005; Paas et al., 2003; Schnotz and Kürschner, 2007). CLT focuses on instructional design strategies to minimize or maximize various positive and negative aspects of cognitive load (or mental effort) in working memory that will ultimately increase consolidation and schema formation. Although cognitive load theory is not without its criticisms (de Jong, 2010; Schnotz and Kürschner, 2007), it provides a useful starting point to describe the theoretical basis for integrating the creative arts into economics classrooms. The three components of working memory described in CLT are intrinsic, extraneous, and germane cognitive load (see Fig. 2).

Intrinsic cognitive load represents the difficulty of the material to be learned as well as the exogenous expertise of the learner. For example, a concept that requires many pieces to understand the whole would be more complex (especially for someone lacking in background knowledge) than something that could be understood as a stand-alone component. Although in some respects intrinsic load is thought to be fixed (the inherent level of difficulty cannot be manipulated per se by innovative pedagogy), some have suggested that intrinsic load can and should be adjusted to fit the underlying skill set of the learner. For example, Schnotz and Kürschner (2007) identify a 'zone of proximal development' that aligns intrinsic load (higher for more advanced learners and lower for more novice learners) to optimize working memory.

Not surprisingly, attention to the demands on working memory is most beneficial when the information to be learned is naturally high in intrinsic load (Artino, 2008; van Merrienboer and Sweller, 2005). This makes intuitive sense – material that requires complex analytical skills to make appropriate connections is more responsive to small changes in design, as opposed to information that is relatively easy and straightforward, because it is not overly taxing on working memory in the first place. In the context of the economics classroom, the subject matter is naturally high in intrinsic load, i.e., requires multiple steps to understand relatively complex and sometimes unintuitive concepts; therefore, the gains from improved instructional design strategies that target the limitations of working memory are potentially large. For example, to understand market forces of supply and demand, students are tasked with multiple levels of comprehension, typically including mathematical

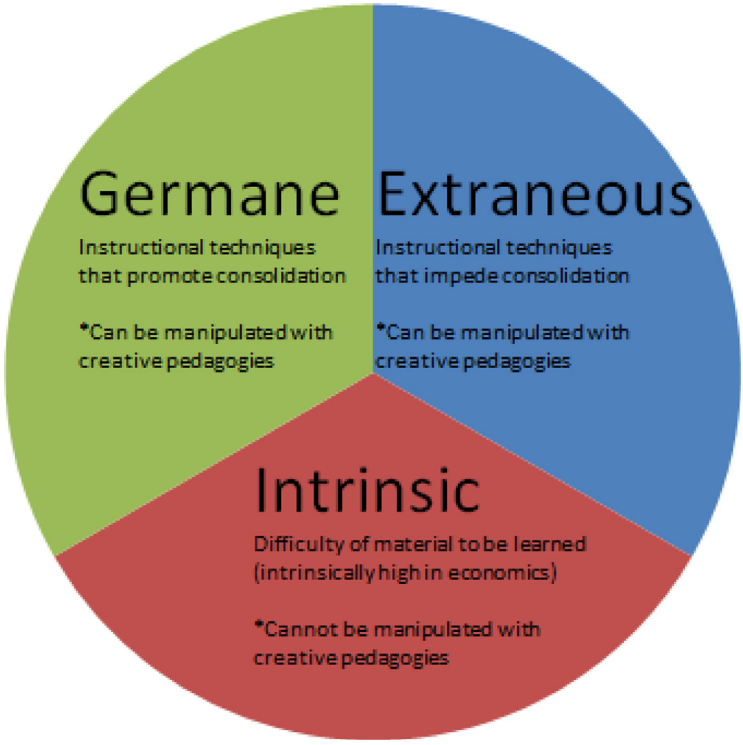

Fig. 2. Types of cognitive load.

and graphing representations. They must understand how these forces interact, what causes a shift versus a movement along the curve, and how to interpret these theoretical interactions in the real-world. These definitions and concepts are paired with mathematical and graphing applications to further tax the learner's cognitive load.

Extraneous cognitive load is defined as instructional techniques that require the attention of working memory but do not ultimately facilitate learning. Extraneous cognitive load represents an unnecessary barrier to learning, and strategies specifically designed to reduce extraneous load have been noted to be effective (van Merrienboer and Sweller, 2005). To draw the connection to economics, recent arguments suggesting the standard tools of economic pedagogy – lecture and textbook – are less effective than active learning techniques (Becker et al., 2006; Hansen et al., 2002) suggest that present economic pedagogy is unnecessarily high in extraneous cognitive load. More specifically, according to a survey by Watts and Becker, 2008 economists continue to rely predominantly on chalk and talk techniques, despite overwhelming evidence in support of more active teaching styles to facilitate learning (Hardiman, 2012; Rinne et al., 2011). The last section of this paper provides creative counter examples to the standard chalk and talk approach that would by design reduce extraneous load on the learner.

The final type is germane cognitive load, which represent instructional techniques that enhance a learner's understanding of the linkages between and among concepts, which facilitates schema construction and memory consolidation. Germane cognitive load promotes the development of schema, which necessarily increases mental effort of the learner. For this reason, the pedagogical strategy with respect to germane cognitive load can be conceived of as an optimization problem subject to the constraints of limited working memory capacity. To be effective, strategies that increase germane load must not exceed the capacity of working memory, and are typically met with a balanced reduction in extraneous cognitive load. For example, recent work by Leahy and Sweller (2008) apply

CLT to understand the role of imagination in memory transfer. Their work suggests that when intrinsic load is high, imaginative learning, which they define as mentally rehearsed performance as opposed to directly reading instructional materials such as textbooks and notes, assist students in the construction of schemas and long-term memory transfer (i.e., optimize germane load). In other words, students are more able to understand how the individual parts fit together to create the complex whole under scenarios of imaginative thought. This concept is supported by additional research exploring the role of imagery as a mnemonic tool for organizing complex information (Rubin, 1995), all of which suggests that pedagogical approaches that incorporate imagery may increase learning, particularly in disciplines such as economics that are naturally high in intrinsic load. Similar work by Leutner et al. (2009) and Roediger (2013) suggest that exercises in mental imagery increase learning in the natural sciences, concluding that imagery fosters deeper processing through efforts to mentally transform verbal information into pictorial information. Similar to imagery, the mnemonic potential of rhyme and meter have been shown to improve memory and recall of complex information (Gardner, 2011; Rubin, 1995).

To summarize, CLT proposes economics instruction be designed to optimize the limited capacity of working memory, which will increase the natural ability of the learner to consolidate memory to long-term storage, i.e., promote economic literacy. This is done by considering the constraints of high intrinsic load and limited working memory capacity, while designing pedagogical strategies to reduce extraneous load and simultaneously enhance germane load. Put more simply, we cannot change the difficulty of the material or the starting point of the student, but we can teach it more efficiently to improve learning outcomes.

4. Applying theory to creative arts in economics

So how exactly do the creative arts stimulate learning within the context of cognitive load theory? The creative arts provide an alternative strategy to more efficiently balance the constraints of working memory by encouraging schema development and consolidation to long-term memory storage. Hardiman (2012) and Rinne et al. (2011) provide an appropriate framework for this in their application of cognitive psychology and neuroscience to the Brain-targeted Teaching Model. They argue for creative arts integration as a way to improve long-term memory consolidation, in part through increased motivation of students as well as promoting sustained attention to task. The argument in favor of the creative arts further emphasizes that it can be used to promote deeper conceptual meaning, especially for information high in intrinsic load such as economics. The research identifies eight characteristics of creative arts pedagogy believed to improve learning and long-term memory consolidation (Hardiman, 2012; Rinne et al., 2011), including repeated rehearsal, elaboration, generation, enactment, production, effort after meaning, pictorial representation, and emotion and memory. Table 3 provides a full list of descriptions, along with examples of creative arts strategies that might be applied to the economics classroom.

I will draw specific focus to three of these characteristics – elaboration, generation, and repeated rehearsal. Research shows that the more elaborately we encode information at the moment of learning, particularly if the information is personalized, the more likely we are to remember it (Medina, 2008). In other words, elaborated information is more likely to facilitate consolidation from short- to long-term memory by both maximizing germane cognitive load and reducing unnecessary extraneous load on the learner. Providing examples that resonate with students, or even better, requiring students to compose their own real-world examples (see Bohanon, 2012; Ziliak, 2009 for excellent examples of this), help capitalize on the memory potential of elaboration. Using the creative arts to elaborate economic concepts at the learning phase, particularly drawing on the mnemonic potential of rhyme, meter, and imagery in poetry (Gardner, 2011; Rubin, 1995) can provide a powerful tool to increase learning within the economics classroom.

For example, I presented the following creative writing opportunity to my class as part of a homework assignment. Students were given the choice to respond to the same question using either standard short essay prose or creative writing.

Table 3
Characteristics of creative arts pedagogy.

Type	Description	Example strategy in an economics classroom
Elaboration	Memory transfer improves with more elaborate information, especially if it can be related personally to the student	Create descriptive poetry related to the economic concepts
Generation	Memory transfer improves with generated information as opposed to information directly provided to the student	Journal or blog about daily experiences related to economic concepts, encouraging use of alternative forms of writing
Enactment	Memory transfer improves when students actively perform information as opposed to reading it	Create and perform mini-skits about a daily experience students have chronicled in their journals
Production	Memory transfer improves when words are produced aloud rather than read silently	Read the assigned literary passages or discuss original art aloud
Effort after meaning	Memory transfer improves when effort is required for interpretation as opposed to obvious meaning	Discuss literary passages or visual art as it relates to economic concepts
Pictorial representation	Memory transfer improves with visual materials	Create or discuss visual art related to the economic concepts
Emotion and memory	Memory transfer improves when information carries emotional meaning (positive or negative) as opposed to more neutral content	Group discussions or book clubs focused on specific areas of topical interest
Repeated rehearsal	Memory transfer improves with repetition; provides students an outlet to rehearse information in new and creative ways	All of the example strategies noted above provide some element of repeated rehearsal

Example question: Provide a brief critique of one of the core assumptions of the neoclassical model. Describe the limitations of that assumption in practice, and provide an example of a plausible real-world scenario not already discussed in class in which you believe it would not hold (limit 200 words).

> *Alternative creative assignment (do one or the other): Choose one of the core assumptions of the neoclassical model, and construct an original creative piece that similarly describes the information requested in the traditional assignment above.*

An acceptable short answer prose response might describe rationality as an assumption, and the pros and cons of this assumption to support economic reasoning. A creative response would achieve the same objective without the constraints of standard prose. It also would provide an additional step of personalization and ownership of the concept, requiring students to use imagery and in some cases rhyme and meter in their response. The following example of a student response in haiku is provided below, while others attempted more elaborate poetic forms.

> *What do I purchase?*
> *I am a rational man.*
> *Cigarettes, of course.*[2]

Generation of material is one of the critical components of creative arts in the economics classroom, because it is the one that most relies on student creativity and imagination. Ideally, the discussions and assignments will provide some level of autonomy to the student to pursue a topic area and form of artistic expression that best suits their interests. When given the opportunity to be creative, students will often provide quite insightful interpretations of concepts they would have otherwise never fully grasped through reading and lecture alone.

For example, in response to an open-ended extra credit opportunity to produce creative work related to an economics concept of their choice, students produced a range of unique poetry and art

[2] Student author, Joseph Sacchi.

that increased the depth of experience for the entire class. Love was a common theme, as a few wrote poetry related to value and opportunity costs, and another produced a valentine card that visually represented the elasticity of demand for love (in this case inelastic). Others wrote parodies of existing poets and writers, such as a synopsis of the course in the language and illustration of a Dr. Seuss book, as well as a parody on a well-known poem by William Carlos Williams, The Red Wheelbarrow:

so much depends
upon

a red wheel
barrow

whose price is
elastic

next to so many
cheap green ones[3]

To build upon this example, a follow-up extra credit assignment specifically requested students develop a creative parody of an existing song, poem, or other creative work to describe the market forces of supply and demand. In response, many students selected popular songs that resonated with them, and adapted the song lyrics to fit concepts related to the shape of the supply and demand curves, market forces shifting these curves, and equilibrium.

A final characteristic worthy of drawing specific attention to here is the opportunity for repeated rehearsal fostered by creative arts integration in the classroom. Repetition is quite possibly the oldest and most accepted strategy for memory consolidation; even if all other desired outcomes of a creative project fail, it has at a minimum required the student to review and rehearse the material from a prospective that by design is unique from the textbook or lecture. Repeated rehearsal need not come only from student creative work, but the instructor might also provide alternative modes of expression to represent a given topic.

However, it is important to note that it is not necessary for an instructor to create original art to successfully use these techniques in the classroom. Simply being familiar enough with existing forms of artistic expression to lead a discussion, or allowing students to create their own art, would be sufficient to take advantage of the approaches outlined here. The extent to which standard textbooks could begin to supply examples and exercises that relate economic concepts to varied forms of creative expression would go a long way toward facilitating their use in the classroom. While the examples described here are developed for the small to medium size economics classroom, adaption to the large principles class is also possible. For example, providing textbook reading assignments paired with short literary themes, art, and music, or opportunities to generate short creative works such as haiku are feasible even in a large classroom. Instructors might also develop teaching materials that integrate creative work into their classroom lectures and break out small group discussions.

While the learning curve for implementing various creative arts in the economics classroom may be steep for some instructors, it need not serve as a barrier. Based on the naturally high intrinsic cognitive load of economics material, learning strategies such as the creative arts that optimize working memory are likely to improve student outcomes, even with relatively small changes to the curriculum. The combined evidence of the cognitive, neuroscience, and economic pedagogy literature suggest that the benefits likely outweigh the start up course preparation costs. The classroom examples presented in Table 3 provide a range of potential formats to choose from, and can be adapted to the interests and knowledge of the instructor. Economics principles textbooks and supplements

[3] Student author, John Dugan.

could be designed to facilitate the use of creative arts by providing a range of examples drawn from music, literature, poetry, and art, along with discussion questions and potential assignments.

5. Conclusions

This paper reviews the available evidence on the integration of creative arts in economics, and draws from the cognitive and neuroscience literature to develop theoretical support for more widespread use of these techniques in the classroom. The research suggests that creative arts activate important neurological pathways that aid the transfer of information from short- to long-term memory, where it can be retrieved for future problem-solving. Based on the principle that the capacity of working memory is limited, the creative arts represent an approach to optimize mental effort, improve learning outcomes, and ultimately increase economic literacy. More research on learning outcomes in economics classrooms is needed to understand the full range of potential benefits and target strategies related to creative arts.

There is no shortage of metaphors in economics that relate value and utility to physics and mechanics-based models, yet the challenges students face in the real-world require creative thinking and human interaction. The fresh metaphors and imagery present in artistic expressions such as poetry can serve to deepen and clarify conceptual meanings that are presently steeped in dry language that students fail to fully understand, much less remember past the exam. To encourage meaningful learning, students must be able to mentally organize and retain the information, and be able to adapt their knowledge to new information. The creative arts represent a natural way for students to learn and express their understanding of economics in a more personal and memorable way, and the evidence suggests this approach will improve learning outcomes and economic literacy.

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