The Artistry of Innovation: Increasing Teachers' Artistic Quotient for Innovative Efficacy

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Abstract

This article presents a new model of building capacity for innovative teaching that I call *Artistic Quotient* (AQ). The purpose of the study was to test the model with generalist teachers who were registered in a professional learning program for innovative teaching through the arts. The procedure employed a one-way, within-subjects, quasi-experimental design using psychometric scales to measure program effects through pre- and post-surveys. Results include a statistically significant increase in teachers' creative and aesthetic capabilities and innovative teacher efficacy, with the conclusion that increasing teacher AQ increases innovative teacher efficacy. Implications for teacher preparation, professional learning, and innovation education are discussed.

Keywords: artistic teacher, innovative teacher efficacy, Artistic Quotient (AQ)

Résumé

Cet article présente un nouveau modèle de développement de compétences en enseignement novateur que j'appelle « Quotient artistique » (QA). Le but de cette recherche était de tester le modèle avec des enseignants généralistes inscrits à un programme de perfectionnement professionnel en enseignement innovant par les arts. La procédure suit un plan de recherche unidirectionnel, intrasujet, et quasi expérimental, et utilise des échelles psychométriques pour mesurer, via des questionnaires avant et après l'intervention, les effets du programme. Ces résultats montrent une augmentation statistiquement significative des compétences créatives et artistiques ainsi que de la productivité des enseignants innovants, menant à la conclusion qu'augmenter le QA des enseignants innovants accroit leur efficacité. Les implications concernant la préparation, le perfectionnement professionnel et l'innovation pédagogique sont discutées.

Mots-clés : professeur d'art, efficacité des enseignants innovants, quotient artistique (QA)

Acknowledgements

Introduction

With an urgent emphasis on student performance juxtaposed with declining levels of student engagement (Ainley & Patrick, 2006; Dunleavy, Milton, & Willms, 2012; Martin, 2018a; Willms, 2003), the pressure is on for teachers to come up with innovative ways to effectively achieve learning outcomes. Arts integration can be one of those ways, defined here as the regular development in and use of arts-based methods to understand and represent knowledge in other subjects (Bolwell, 2011; Buck & Snook, 2017; Martin, 2016; Martin, Snook, & Buck, 2018; Rabkin & Redmond, 2015). There is growing evidence that arts integration has numerous, positive effects (Martin, 2018b; Robinson, 2001, 2006; Smithrim & Upitis, 2005) and can be an empowering tool for inclusion that draws students into their learning, including second/additional language learners (Martin & Calvert, 2018). Through the creative and artistic processes of arts-based pedagogy, arts integration offers fertile ground for teacher innovation.

Innovation is the process through which ideas transform into new products or ways of doing things (Baregheh, Rowley, & Sambrook, 2009). Teacher innovation is the process of transforming ideas into new pedagogical products or practice. In this educational domain, lack of adequate experience or preparation related to innovation prevents many teachers from being ready and willing to experiment with pedagogy (Craft, 2001, 2005). Despite interest in or value for the arts, the majority of generalist teachers (hereafter referred to as *generalists*) are often ill-equipped to design and deliver arts-integrated lessons. As a result, they opt to leave the *risky, artsy* stuff to the specialists, or worse, to no one at all. The consequence is a system of students largely deprived of an arts-enriched education. Notably, this is not because the teachers do not have what it takes to be artistic or innovative; rather, many simply have not been taught or encouraged to explore their artistic or innovative potential, and it lies dormant.

Educational research has investigated the traits, factors, classroom practices, and other variables of creative and innovative teaching (Beetlestone, 1998; Cremin, Barnes, & Scoffham, 2006; Cremin, Burnard, & Craft, 2006; Frost, 2012; Fryer, 2001; Horng, Hong, ChanLin, Chang, & Chu, 2005; Jeffrey & Craft, 2004; Sawyer, 2006); however, there are few models or programs that prescribe how teachers can acquire the necessary capabilities for innovative work (Henriksen & Mishra, 2013; Reilly, Lilly, Bramwell, & Kronish, 2011). Likewise, few models exist that develop teacher capabilities for planning

and facilitating effective arts integration. Questions emerge: What can we learn about innovative practices in education from teachers who effectively use arts integration? What capabilities are essential for effective arts integration and also enable innovative teaching? Can these capabilities be learned as part of teacher education and/or professional learning, and if so, what are the effects?

Based on these questions, the aim of this article is to describe and explore a new conceptual framework for increasing teacher capacity for innovative teaching through the arts. Specifically, this study investigates the effects of a professional learning program designed to help teachers increase their confidence as innovative teachers by developing their capabilities in artistic learning design and facilitation.

First, I define and describe common artistic practices of *artistic teachers*. I then articulate three capabilities that result from these artistic practices, each representing an ability essential for working within an innovative context. I draw upon social learning theory for a theoretical explanation of mainstream resistance to arts integration and use this theory to build a new theoretical model that proposes how capacity building through artistic capabilities will increase innovative teacher efficacy. I then describe an empirical research project that tests the model in practice, and share findings from quantitative, psychometric analyses. I conclude with a discussion of the results with implications for teacher preparation, professional learning, innovation education, and future research.

Theoretical Underpinnings

What Is an Artistic Teacher?

Artistic teachers are teachers who develop and use arts-based methods with their students to understand and represent knowledge in other subjects (Martin, 2016; Martin, Snook, & Buck, 2018; Rabkin & Redmond, 2015). Artistic teachers thrive in the artistry of their work (Leggo, 2005; Sawyer, 2006). Through their arts-based capabilities and the artistic processes they employ, good arts integrators are inherently innovative teachers (Jeffrey & Craft, 2004).

Artistic teachers are excited by the creative processes of learning design (they approach planning like artists in the studio); they constantly tinker with their practice

(they revise and experiment with lessons to rarely do the exact same thing twice); and they make learning visible (they curate exhibits of student learning as masterpieces to be celebrated). Artistic teachers are comfortable with risk and uncertainty. They construct "encounters and create imaginative settings that stimulate diverse and largely unanticipated responses and solutions from students" (Eisner, 1972, p. 4). Indeed, the emergent and creative processes of arts integration are often the same as those experienced by artists (Csikszentmihalyi, 1997; Eisner, 1985, 2002; Irwin, 2013). Thus artistic teachers use artistic practices to approach learning design in the same way artists approach a blank canvas: They delight in the creation and messiness of engaging the senses for learning, confident that something wonderful will result from the work. For artistic teachers, teaching is their art form and student learning is their work of art (Woods & Jeffrey, 1996; Sawyer, 2006).

As an artistic teacher for over 22 years, I have worked directly with students in schools to integrate art, dance, drama, and music into the core subjects. Through this experience, I have noticed how intrinsically motivated I am by the process of learning design, and I often experience creative flow when I emerge from a planning session, feeling invigorated and energized rather than exhausted (Csikszentmihalyi & Csikszentmihalyi, 1988; Csikszentmihalyi, 1997). I have also noticed that I am deeply satisfied by the artistry and innovation in my teaching and find the artistic practices of arts integration cognitively rewarding.

Over the years, I have facilitated many professional learning sessions with teachers who want to use arts integration in the classroom. It is common for some teachers to want me to simply show them how to do something, step by step, so they can copy it in their class; however, there are always others who really want to understand how to design and facilitate innovative arts-integrated lessons. In my experience, I have come to see that the real rewards of arts integration for the teacher do not come from replicating someone else's plan; they come from being innovative and experiencing one's own artistry as part of the arts-based work. Given these benefits, I have pondered why there are not more generalists using the arts in schools. One answer may lie in the field of motivation studies and social learning theory.

Social Learning Theory and Innovative Teacher Efficacy

For the majority of generalists, social learning theory explains that these teachers will only be willing to use arts integration if they perceive they have the right level of efficacy to do so (Bandura, 1977, 1997, 2001). Efficacy is one's confidence in having the skills and abilities to accomplish a task, and according to Bandura (1997), individuals are only motivated to undertake a particular task when they perceive that they have the capabilities for success.

In educational research, teachers' confidence in their capabilities to bring about desired educational outcomes is referred to as *teacher efficacy* (Guskey, 1988; Tschannen-Moran & Hoy, 2001). In the case of innovative teacher efficacy, the innovative teachers taking creative risks in the classroom (arts-based or otherwise) can be understood as the ones who perceive that they are capable of doing so. Therefore, whether or not teachers have confidence in their capabilities for designing innovative teaching has a direct influence on their innovative teacher efficacy. Fortunately, efficacy levels can be built up through positive experiences (Bandura, 2001, 2006), such as targeted capability development in teacher education or professional learning in practice.

To address this I have distilled a theoretical model that targets the capabilities required for planning innovative arts integration. Within the model, I have identified three practices that are common to artistic teachers and propose that through these practices the following three capabilities required for innovation and arts integration will develop: (1) creative capabilities, (2) design capabilities, and (3) aesthetic capabilities.

Artistic Teachers Engage in Creative Practice

Artistic teachers build creative capabilities through creative practice. They are motivated to make their ideas come to light (Eisner, 2002). Engaging in creative practice does not mean someone is an artist, and it does not have anything to do with talent; it is about a willingness to generate ideas, try something new, and represent concepts or convey meaning through different forms (Bruner, 1962; Eisner, 1985, 1993, 2017; Guilford, 1950). Likewise, having creative capabilities is not a measure of creativity (*how* creative one is); rather, it is about one's ability *to be* creative and to undertake or facilitate creative activity. This is very different from notions of creativity as something to be scored in terms of novelty, quality, or social value (Sternberg & Lubart, 1999).

Artistic teachers delight in the surprise of creativity and often go to elaborate lengths to set up a learning environment that piques curiosity, ignites imagination, and engages the senses (Aoki, 2004; Greene, 2000; Irwin & De Cosson, 2004; Pinar & Grumet, 2015; Pinar & Irwin, 2005). Having creative capabilities is about being willing to try new methods as part of one's practice, and it is about having the ability to access the right resources to model creative methods in the classroom (Ferrari, Cachia, & Punie, 2009). It is not unusual for artistic teachers to learn a new skill alongside their students before applying it in a learning context. This, again, is very different from the traditional belief that in order to teach through the arts, one must be a specialist in the arts. Artistic teachers know they are capably creative, and that is enough.

One of the most common reasons for generalists to resist teaching through the arts is a belief that they are not creative, capable artists (Martin, Snook, & Buck, 2018). Such thoughts are cognitive barriers to teachers' willingness to be innovative and to try creative ideas in the classroom. Returning to social learning theory, without a belief in their capabilities to do something, teachers will be less motivated to do it (Bandura, 1982, 2001). If this is true, the generalists who do not employ creative practice may have a belief that they are incapable of creative endeavours, which can lead to low innovative teacher efficacy. However, since efficacy can increase through positive experience, I hypothesize that increasing teachers' *creative capabilities* will increase their innovative teacher efficacy.

Artistic Teachers Engage in Design Thinking

Artistic teachers build design capabilities through design thinking. They approach planning differently than teachers with sequential, scheduled lesson plans do (Aoki, 2004; Greene, 2000; Pinar & Irwin, 2005). As part of their teaching practices, artistic teachers do not always know where the lesson will go and intentionally embed provocation with ample opportunity for student agency, curiosity, and ideation (Beghetto, 2007; Irwin, 2003; Martin, Snook, & Buck, 2018; Martin, 2018a). Artistic teachers prefer to brainstorm and gather many perspectives, and they value collaboration and input from other teachers and students (Craft, 2005; Martin, 2019; Woods & Jeffrey, 2002). They often design learning tasks with a growth mindset (Dweck, 2006) and assume that everyone has the potential for artistry, rather than the talented few. As such, artistic teachers embed

flexibility within the lessons to allow for emergence, and this requires regular practice in design thinking.

Design thinking is a natural practice in the generative inquiry that the arts empower (Irwin & De Cosson, 2004), notably through project-based questioning, revision, product design (re-design), and reliance on a social system (Dorst, 2011; Dym, Agogino, Eris, Frey, & Leifer, 2005; Rowe, 1991). Moreover, design thinking allows for iteration, disruption, and alternative directions while still working toward a goal or purposeful end (Dunne & Martin, 2006). Through this, design thinking provides the flexibility in facilitation necessary for creative work while providing enough structure to ensure time is used effectively to meet outcomes.

Valuable cognition takes place during the design process (Garbuio, Dong, Lin, Tschang, & Lovallo, 2018). The process of art-making is the main focus in arts integration, while the end product makes that cognition and learning visible. Artistic teachers are able to design activities for discussion, reflection, and connection-making in ways that guide learners to be metacognitive and to make thinking transparent (Beghetto, 2007; Leggo, 2005; Simplicio, 2000). In the end, artistic thoughts are transcribed, or represented, in physical form (Eisner, 2002); but it is the means to the end that gives the form meaning.

Research shows that exposure to and use of design thinking aligns with a growth mindset (Blackwell, Trzesniewski, & Dweck, 2007), while at the same time it conditions individuals to be experimental in their practice. This is because prototyping (a core concept in design thinking) is based on trial and error rather than on getting it right the first time (Scheer, Noweski, & Meinel, 2012). Artistic teachers, as design thinkers, understand that mistakes are valuable ways to learn, and this includes making mistakes, as a teacher, in front of one's students. Hence, teachers who practise design thinking acquire capabilities that allow for pedagogical adaptation in the moment, revision when something does not work, and comfort with the unpredictability (and inherent vulnerability) of an arts-based context (Beghetto & Kaufman, 2011).

For teachers who are unfamiliar with arts-based methods, fear of losing control and issues of classroom management are common reasons for resistance (Boden, 2001; Craft, 2001; Sawyer, 2006). Inexperience with facilitating arts integration can be daunting, especially in figuring out the timing, messiness, and expected unpredictability of any artistic endeavour. Design thinking provides a framework for arts-based methods that

allows for creative processes while keeping a goal and timeframe in mind. Design thinking comes naturally to teachers who have been trained in the arts because of its parallels to creative practice (Eisner, 2002; Guilford, 1950; Wallas, 1926). The creative product is at the end of a long, iterative process through which the innovator or art-maker tinkers, changes direction, adds new ideas, and abandons others, all until the work is deemed complete (Simplicio, 2000; Malaguzzi, 1993).

Generalists who do not use arts integration may have a fixed mindset that they can only manage their class through pre-planned, linear activities, which can lead to low innovative teacher efficacy (Dweck, 2006; Simplicio, 2000). Fortunately, a fixed mindset can be converted to a growth mindset through purposeful intervention (Dweck, 2006; Horng et al., 2005). Thus I hypothesize that increasing teachers' *design capabilities* will increase their innovative teacher efficacy.

Artistic Teachers Engage in Aesthetic Awareness

Artistic teachers build their aesthetic capabilities through practising aesthetic awareness. They pay attention on a different level (Irwin, 2003). They notice deeply, they wonder, and they generate creative questions as part of their everyday practice (Aoki, 2004; Greene, 2001; Grumet, 1987; Jeffrey & Woods, 2003; Pinar & Irwin, 2005). Artistic teachers dig into juicy inquiry topics alongside their students and allow the schedule to be generative and emergent (Beghetto & Kaufman, 2011). They focus on the affective, expressive, and somatic, with dedicated time for aesthetic observations and for students to linger in the sensory and the wondrous (Leggo, 2005, 2011). According to Martin, Snook, and Buck (2018), "We know that to embody knowledge is to experience something live and through the senses, and that embodied learning moves the learner to knowing beyond language—often antecedent to it" (p. 4). Artistic teachers practise aesthetic awareness and rely on their senses to signal what to do next. They provoke deep thinking, are fully engaged in their students' work, and model how to translate ideas into form (Eisner, 2017; Leggo, 2005).

In terms of teacher preparation, aesthetic thinking (Eisner, 1985, 2017) and aesthetic awareness (Sameshima, 2008) are central in the preparation of educational specialists in art, dance, drama, and music (Greene, 2000; Irwin, 2003; Snowber, 2012; Springgay, Irwin, & Leggo, 2007). Being able to sense the mood of an audience or gauge

how long to hold a note are both examples of aesthetic sensibilities in the arts. Likewise, being able to press students to fully express themselves, or create a safe environment for students to act in front of others, requires aesthetic awareness (Sameshima, 2008). Arts educators are expected to have an awareness of the subtleties and nuances of arts-based work, and if they do not arrive to the post-secondary program with this awareness, they are expected to develop it before teaching the arts to others. Within the field of arts education, aesthetic capabilities are considered critical to artistic teaching, and are part of an attunedness that must be acquired (Aoki, 2004; Eisner, 2017; Pinar & Irwin, 2005; Sameshima, 2008; Snowber, 2012, 2016).

Outside the field of arts education, aesthetic aspects of learning are often ascribed to the mystical and mysterious (Ferrari, Cachia, & Punie, 2009)—if not the impractical and nonessential—very much in the same way that creativity is often ascribed to the talented and arts education to non-core options. Many educators are taught that everything can be measured with the right rubric (Beghetto, 2007), and assessment relies on what can be seen as measurable evidence—certainly not what can be felt or experienced! Unfortunately, this does not serve generalists well when they attempt to facilitate arts integration.

Arts-based lessons without aesthetic considerations can feel contrived, awkward, and artificial. The arts are not like other subjects. Timing matters, expression is central, creativity is key, and openness to the unexpected is the norm. Such soft skills are difficult to teach to teachers who think of them as inherent skills, like talent, rather than something they can acquire through practice. Generalists who do not use arts integration may believe that they do not have aesthetic capabilities which can lead to low innovative teacher efficacy. Thus I propose that increasing teachers' *aesthetic capabilities* will increase their innovative teacher efficacy.

Artistic Quotient (AQ): A New Capacity for Innovative Teaching

The three practices of artistic teachers (creative practice, design thinking, aesthetic awareness) lead to capabilities that make up a capacity for artistic innovation. I call this capacity *Artistic Quotient* (AQ) and define it as a heuristic construct that represents an individual's capacity for planning and facilitating artistic or innovative projects. Artistic teachers have high AQs. Teachers with high AQs have the capacity for pedagogical innovation.

At this point, it is important to reiterate that the use of the term quotient is for heuristic purposes, and AQ is used in analogy to the mainstream concepts of *Intelligence Quotient* (IQ) and *Emotional Quotient* (EQ), each with their own controversial lineage in academia (Goleman, 2006; Gardner, 1999, 2011; Wechsler, 1974). In fact, one of the topics of controversy is the fixed trait vs. learnable skill debate, and AQ may spark similar discourse. However, I make a stand here to state that the construct of AQ is strongly rooted in the notion that artistic capabilities can be developed through artistic practices over time, and that AQ is not a fixed score but a malleable capacity that can increase when one holds a growth mindset.

Remember, according to social learning theory, individuals are only motivated to perform a task if they perceive high levels of efficacy. Specific to innovative teacher efficacy, AQ will directly influence generalists' innovative teacher efficacy, and thereby their motivation to use innovative pedagogy like arts integration (Guskey, 1988; Tschannen-Moran & Hoy, 2001). Innovative teacher efficacy can increase or decrease depending on perceived levels of the capabilities that make up AQ. As such, I propose that professional learning embedded in artistic practice will develop the three artistic capabilities of AQ (creative, design, and aesthetic), which will increase innovative teacher efficacy.

New Theoretical Model for Innovative Efficacy

We now return to social learning theory to derive a new conceptual framework for teacher professional learning that develops AQ and increases innovative efficacy. This model proposes that low AQ leads to low innovative teacher efficacy, explaining why so many generalists are inhibited from innovating in the classroom, especially through arts integration. However, it also proposes that AQ can be increased through artistic practices, and the effects of increased creative capabilities, design capabilities, and aesthetic capabilities. Figure 1 below presents this framework, and shows that, as a causal model, an increase or decrease in each of these capabilities will, in turn, moderate levels of innovative teacher efficacy.
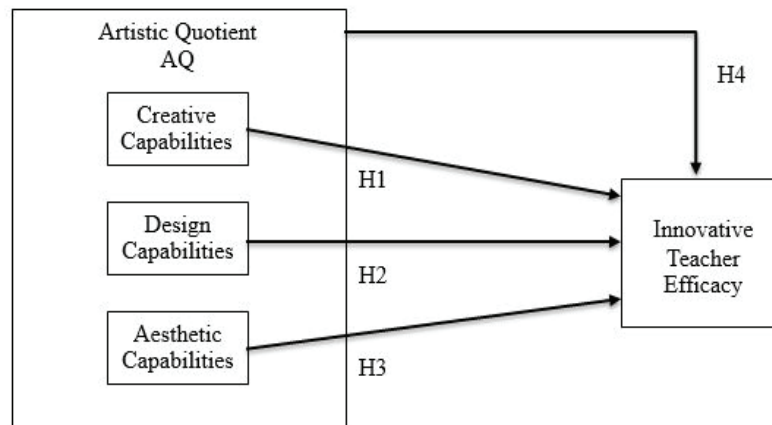
Figure 1. Conceptual framework of AQ and its relationship to innovative teacher efficacy

Figure 1 illustrates the relationship between the variables of AQ and innovative teacher efficacy. It shows AQ as an overarching construct made up of creative, design, and aesthetic capabilities. The framework hypothesizes that an increase in each capability type will increase innovative teacher efficacy (H1, H2, H3) and that these scores together (AQ) will moderate levels of innovative teacher efficacy in a positive relationship (H4).

With this new conceptual framework for professional learning, the next logical step is to investigate it in practice. The following empirical study was sparked by the Royal Conservatory of Music, which requested research on the effects of its professional development program for generalist teachers called Learning Through The ArtsTM (LTTA). Through its heavy emphasis on artistic practice, the LTTA program is an ideal prototype for developing the AQ capabilities and is the perfect platform to test the model with teachers.

Empirical Study

The Program

The Royal Conservatory's LTTA program has been a national leader on arts integration since 1994. With a growing need for teachers to understand the artistic processes behind planning and facilitating arts-integrated lessons, LTTA collaborated with artists and educators to design a novel program prototype for teacher professional learning. The LTTA provided specially trained artist-educators to deliver arts-based professional development to generalists by exposing them to artistic contexts and embedding them in artistic practice. The first year of the program involved intensive piloting of professional learning experiences, co-designed with professional artists and the school board's fine arts specialist. In true design-based style, the pilot was tweaked and revised as the artists tinkered with the process and delivery of an emerging curriculum. Within a year, they landed on an effective approach that was centred on the following: (1) Teachers as Learners: teachers were required to experience the program as students (not as teachers seeking resources for the classroom); (2) Time for Practice: teachers were asked to commit for the duration of the program to shift their mindsets and acquire capabilities; (3) Artistic Apprenticeship: professional artists were matched with teachers to coach them on artistic practice and processes.

Generalists from a large school system were invited to participate in the program. They met as teaching teams from their schools and also came together regularly as a large group in which they were creatively provoked with innovative, artistic encounters and immersed in creative practice. For example, on one day, they entered the classroom to find a multimedia art installation, with sound, visuals, and an interactive experience that put them in the centre of the work. Following the provocation, they were asked to respond through arts-based activities infused with discourse of creativity, design, and aesthetics.

The apprentice model of LTTA put a unique spin on the traditional artist-in-residence, as the professional artists were not there to model teaching but rather to model artistic ways of working as innovative teachers. The artists often purposefully disrupted the teachers' creative processes to shift the direction of the work and create discomfort in

such a way that participants had to consider how it feels to be a student learning through the arts as well as their own cognitive and somatic experience. There was early resistance to idea-sharing and creative risk-taking that diminished over time as participants became more familiar with the artistic practices, more comfortable with each other, and more confident in their own capabilities. Overall, the program increased the teachers' exposure to and experience with different creative processes, design-based projects, and aesthetic discourse.

Method, Measures, and Procedure

This study employed a one-way, within-subjects, quasi-experimental pre-test and post-test design. The sample consisted of 52 generalist teachers who were registered in the LTTA program with an interest in learning how to design innovative lessons through media arts integration. Psychometric scales were designed to measure the effects of the program on the variables and relationships of the model. For pre- and post-test measures, participants completed an online survey before and after the program.

The survey was composed of a series of demographic items, followed by a scale for innovative teacher efficacy (24 items), and newly developed scales for creative capabilities (eight items), design capabilities (16 items), and aesthetic capabilities (10 items). All measures used a Likert-type scale to rate their responses, with seven options: *strongly disagree*, *disagree*, *somewhat disagree*, *neither agree nor disagree*, *somewhat agree*, *agree*, and *strongly agree*.

The scale for innovative teacher efficacy was composed of 24 items and adapted from the Ohio State Teacher Efficacy Scale (OSTES) by Tschannen-Moran and Hoy (2001). The original OSTES was 24 items relating to three factors of teacher efficacy: instructional strategies, efficacy for classroom management, and efficacy for student engagement. Given the high reliability of the OSTES (0.94), all 24 items were used, but were revised slightly to be relevant within an innovative, arts-based context (Bandura, 1997). Items all began with the statement, "Through utilizing my current knowledge and experience with artistic practices, I can...." Sample endings included "help students think critically," "establish routines to keep activities running smoothly," and "use a variety of assessment strategies." The innovative teacher efficacy scale had an internal consistency in this sample of 0.97 assessed by Cronbach's alpha.

The scales for measuring the artistic capabilities of teachers were all newly developed for this study. Given the newness of the scales, I assessed levels of internal consistencies for scale reliability, keeping in mind the limitations of the sample size. In testing scale reliability, all four scales performed well (see below). Thus this study provides a reliable scale for teacher efficacy specific to teaching innovation, and new, reliable scales for measuring the three artistic capabilities of AQ.

Creative capabilities were measured based on eight items. Sample items included: "I believe I can generate creative ideas" and "I believe I can convey meaning through the presentation of creative works." This scale had an internal consistency in this sample of 0.96 assessed by Cronbach's alpha, suggesting it as a very reliable way of assessing teachers' creative capabilities. Again, this is not an assessment or measure of their creativity; rather, it is a measure of their perceptions of their capability to be creative.

Design capabilities were measured based on 16 items identified through the literature on design thinking. Sample items included: "Learning has more impact when considering multiple perspectives," "It is important for me to be curious along with my students and staff," "Not knowing the end result or product can be a risk worth taking," and "The best teaching starts with a goal in mind." This scale had an internal consistency in this sample of 0.85 assessed by Cronbach's alpha, identifying a potentially powerful measure for design thinking within an educational context. Since the scale was designed for this project, 14 items specifically referenced teaching, students, or learning, whereas two were general items about design thinking. In order for this scale to be applied in other contexts, it could easily be revised, and it would be fruitful to experiment with revising all of the scale items to be more general in future research.

Aesthetic capabilities were measured based on 10 items. Sample items included: "questions to provoke deep thinking come naturally to me," "I notice meaning in student work," and "I see curriculum outcomes embodied in my students' work." This scale had an internal consistency in this sample of 0.88 assessed by Cronbach's alpha, again indicating a new, effective measure.

The three subscales for the artistic capabilities (creative, design, aesthetic) make up a full scale for AQ, measured based on all 34 items. This full scale is included in the appendices and had an internal consistency in this sample of 0.93. Thus this study provides a brand new, reliable scale for measuring AQ, ready for use by individuals interested in measuring capacity for working on artistic or innovative projects.

Analyses and Results

To test relationships hypothesized in the model, I employed independent samples of *t*-tests specifically to examine whether significant differences occur in participants before and after the program. The theoretical framework of this study hypothesizes that the three artistic capabilities of AQ (creative, design, and aesthetic) will each be positive antecedents that moderate levels of innovative teacher efficacy. Beyond an evaluation of missing data and whether parametric statistics can be employed, an evaluation of baseline performance on the measures of perceived creative capabilities, design capabilities, aesthetic capabilities, and innovative teacher efficacy were assessed. The obtained data were examined to determine whether the underlying assumptions of the proposed statistical techniques could be inferred and would warrant their utilization. This included the evaluation of univariate and multivariate normality at the individual-item and total-score levels for all instruments included in the study. No outliers were identified as occurring within the obtained sample. The total score for all factors examined in this study demonstrated acceptable central tendency, skew, and kurtosis properties and warranted the use of parametric approaches.

Participants demonstrated statistically significant improvements in creative capabilities ($t(13) = 2.53$, $p < .05$), aesthetic capabilities ($t(13) = 4.29$, $p < .05$), and innovative teacher efficacy ($t(13) = 2.03$, $p < .05$). No significant change was noted over the intervention period for design capabilities ($t(13) = .18$, $p > .05$). Tables 1 and 2 provide a breakdown of pre-test and post-test sample means, standard deviations, and sample sizes.

Table 1. Means and standard deviations for the pre-test scales

	Mean	Standard Deviation
Creative Capabilities	42.28	6.86
Design Capabilities	102.64	5.34
Aesthetic Capabilities	55.07	6.56
Innovative Teacher Efficacy	130.57	21.19

Table 2. Means and standard deviations for the post-test scales

	Mean	Standard Deviation
Creative Capabilities	46.35	8.36
Design Capabilities	102.35	7.19
Aesthetic Capabilities	60.64	5.89
Innovative Teacher Efficacy	139.92	20.69

Results revealed that, following the LTTA program, there was a statistically significant increase in creative capabilities and aesthetic capabilities, and in innovative teacher efficacy. Thus there is support for Hypotheses 1 and 3, listed in Figure 1, and for those I reject the null. There was not a statistically significant increase in design capabilities, and there is not support for Hypothesis 2. Regardless, the high reliability of the full scale for AQ (0.93) warranted an investigation of the relationship between the construct of AQ and innovative teacher efficacy.

Despite results for design capabilities, I was still interested in testing the relationship between the full scale AQ and innovative teacher efficacy (H4). A Wilcoxon signed-ranks test was used to compare the pre- and post-test scores to find that there was still a statistically significant change. Tables 3 and 4 provide details of the analysis and relevant test statistics.

Table 3. Wilcoxon signed-ranks test results for AQ and innovative teacher efficacy[a]

		aid_construct_pre	aid_construct_post
N	Valid	14	14
Mean		200.0000	209.3571
Median		200.5000	213.0000
Standard Deviation		15.52	18.21
Skewness		-.016	-.972
Kurtosis		.165	1.216

[a] Multiple modes exist. The smallest value is shown.

Table 4. Relevant test statistics[a] for Wilcoxon signed-ranks test

	aid_construct_pre
Z	-2.701 1[b]
p (2-tailed)	.007

[a] Wilcoxon signed-ranks test

[b] Based on negative ranks

Based on these findings, there is support for Hypothesis 4, and this study contributes valuable, new knowledge in finding that AQ moderates levels of innovative teacher efficacy, and provides evidence that engaging in artistic practices increases the artistic capabilities of AQ, which increases teacher efficacy for innovation.

Discussion

In terms of program effects, there is sufficient statistical support for the claim that the LTTA program for teachers, as designed and tested here, develops creative and aesthetic capabilities in generalists and significantly increases their efficacy as innovative teachers. Theoretically speaking, the LTTA program increases teacher AQ and fosters the mindset and capabilities for innovative teaching. Given the hypothesis of a positive relationship between creative capabilities and innovative teacher efficacy, it is no surprise that an increase in one leads to an increase in the other. The same is true for the hypothesis regarding aesthetic capabilities and innovative teacher efficacy. The study's finding that design capabilities did not increase was unexpected, especially given the overt emphasis on design thinking and design-based language by program facilitators. This suggests one of two things: either the program failed to influence teacher design thinking or the teachers already had inflated levels of design capabilities at the beginning of the program. The high and sustained score combined with the strong reliability of the design capabilities scale (.85) lead me to suspect the latter, but further inquiry is definitely warranted.

Whether or not design capabilities are a necessary factor for AQ also requires further inquiry. In fact, it is highly possible that other constructs could be added to the model, and this study is meant to spark more discourse on the development of cognitive capabilities in teacher education and innovation education. To date, much of the knowledge held within the field of arts education has been relatively isolated from scholars of

quantitative, psychometric research. Even in the field of innovation studies, much of the focus has been at the interpersonal, organizational, or geographic levels (Christensen, 2013; Cohen & Levinthal, 2000; Florida, 2003; Porter, 2001) and few have attempted to deconstruct the cognitive processes taking place within an innovator's mind. To my knowledge, this is the first study to articulate creative, design, and aesthetic capabilities as part of a holistic, acquirable capacity for innovation. In drawing parallels between artistic and innovative work, this article makes a novel contribution to the field of innovation studies by identifying the artistry of innovation.

Regarding the model, the increase in creative capabilities and aesthetic capabilities was large enough to significantly increase AQ in such a way that there was a powerful effect on innovative teacher efficacy. Increasing creative and aesthetic capabilities can increase AQ enough to increase innovative efficacy. Whether or not design capabilities should remain in the model is a topic for future investigation. Based on results here, it is enough to say that teachers who have high creative and aesthetic capabilities have the AQ to be innovative teachers.

Limitations

This study is based on a quasi-experimental design, since teachers were only invited to participate in one program. As such, the study is limited through its lack of random assignment, albeit acceptable practice in psychometric research. The sample size is also a limitation in terms of claims to generalizability, and findings should be interpreted as relevant to this case with this sample. Given the newness of the model and scales, this study was technically a pilot study that provided evidence of reliable metrics. Future research on the model variables with a larger sample size informed by a power analysis will provide more telling data for the general population.

This study was also based on the teachers having school board support to participate in the LTTA program, which required an incredible time commitment on the teachers' parts, and financial support from the school board to cover the cost of substitute teachers in the teachers' absences. This is not the reality for most teachers. Instead, their reality is typically an overburdened schedule with limited resources or time for professional learning. The success of this project would likely have been lessened had the teachers been without the institutional support required for them to truly engage in

the process. Thus, this study is limited by the fact that, despite interests or intentions, teachers are rarely able to participate in such long-term, intensive learning opportunities. However, results here provide strong evidence that with the right administrative support and funding, teachers can learn to be more innovative and effective in the classroom.

Application in Innovation Education

There is potential applicability of the model beyond teaching, particularly in business schools where innovative cognition and behaviour are difficult to teach, yet certainly prized (Ford, 1996; Furman, Porter, & Stern, 2002; Gong, Huang, & Farh, 2009). The model can easily be modified to other specific contexts or even a more general context, in which AQ is antecedent to individual innovation efficacy, as Figure 2 illustrates.
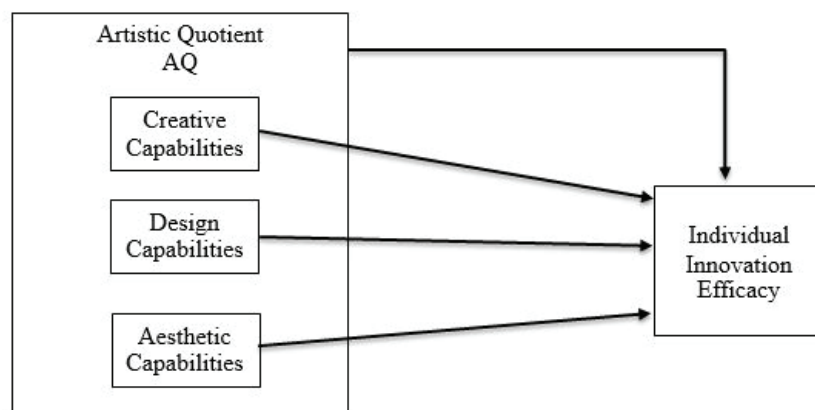

Figure 2. Conceptual framework of AQ and its relationship to innovation efficacy

As Figure 2 shows, in a more general context, the artistic capabilities of AQ are predicted to moderate levels of individual innovation efficacy. The reliable scales for the three artistic capabilities of the model are readily usable to test this, with a required modification of the efficacy scale for individual innovation. There is indeed great potential for research on AQ in a variety of contexts, and AQ offers a new way to teach the soft skills that lead to innovative behaviour.

Conclusion

This article develops and explores a new conceptual framework for increasing generalists' capacity for innovative teaching through arts integration. The empirical study investigated the effects of a professional learning program designed by LTTA for generalists to increase their capabilities and efficacy as artistic and innovative teachers. Through theoretical development informed by social learning theory, these capabilities were hypothesized as antecedent to innovative teacher efficacy in a positive relationship. New psychometric scales were developed and tested, with the result that they all had good reliability with this sample. Overall, results indicate that teachers who have creative and aesthetic capabilities have high AQs, which moderates high levels of innovative teacher efficacy.

These findings have implications for a number of educational stakeholders: For the Royal Conservatory's LTTA program, this study provides an evidence-informed program evaluation that supports the program as a valid way to acquire creative and aesthetic capabilities and increase efficacy for teacher innovation. For school administrators, it identifies data-informed capabilities that are essential to innovative teaching and arts-integrated pedagogical design, suggesting an important area of focus for staff professional learning. For teacher preparation programs, there is statistically significant data to inform generalist teacher preparation, especially in preparing teachers to be able to innovate and teach in engaging ways. For governing agencies, there is evidence of powerful effects when there is adequate time and funding for teacher professional development. Last, but not least, for generalists, this study identifies the specific capabilities required for confidence that they have what it takes to innovate, design, and facilitate experiences that empower creativity, promote design-thinking, and delight the senses.

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