Impacts of Arts Integration in Research Universities

(working paper)

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A2RU Research Insights

Impacts of Arts Integration in Research Universities:

Overview

From 2012-2015 (as part of the Mellon-funded Supporting Practice in the Arts, Research and Curricula, or SPARC, project), we interviewed upper-level administration, faculty, and students at 38 partner institutions about the impact of their arts-integration initiatives, including teaching, research, and community projects. We asked about what impact they hoped for and what impact they actually saw, as well as how they measured impact. A literature review and a survey of approximately 4000 University of Michigan undergraduates' arts engagement experiences supplemented the SPARC interviews. With this white paper, as well as with shorter ones derived from this white paper and targeted to particular areas of impact, we present a synthesis of our findings from that research.

In addition to these narrative documents, our insights into the impacts data are available as a map. Both these resources have distinctive functions; readers can use the map for a broad overview of the impacts taxonomy, browsing for categories of impact that interest them. Accompanying instructional materials provide a rubric for articulating the broader impacts of programs and projects. Alternatively, the narrative documents go deeper into the research, discussing some impacts in detail, providing specific examples of many types of impact, and addressing measurement of impact. Both the map and the narratives are meant to ignite discussion, fuel research, and support clear communication. We encourage users to appropriate these resources as tools for illustration, explanation, and advocacy.

https://www.a2ru.org/projects/impacts/

While the impacts taxonomy is a rich source of information, it is most exciting as a jumping-off point to further exploration. First, the structure of categories and types we created is dynamic and adaptable—What alternative organizations might be generative? Where are there gaps, where important types of impact are absent? Then, while this data is a taxonomy of the impacts our member institutions have experienced and that are reported in the literature, it doesn't attempt an explanation of how these impacts function; its aim is to describe rather than to establish proof. We look forward to building out this data set with additional research that explains and verifies, and welcome your insights and recommendations.

Contents

Executive Summary

Where the arts have a lively presence on campus, and interact with other disciplines as well as across the boundaries of the university, we find a range of impacts. Some of them are high-level—recurring and broadly applicable—while others are specific to a particular group or field.

Chapters 1 and 2: Recurring impacts

Two categories of impact—*New Perspective, Awareness, and Understanding* and *Working Together*—recur across groups and situations. These recurring impacts take on differing characteristics according to where they happen, but we find examples of them again and again. For many, these impacts—including thinking beyond disciplinary boundaries, new understanding, and bringing together diverse thinkers—are at the heart of arts integration.

Chapter 3: A unique way of knowing

The arts entail a unique way of knowing, just as mathematics, science, and language do. When the arts are integrated with other disciplines, yet another, interdisciplinary way of knowing emerges.

Chapters 4: A dynamo for arts integration

Three of the categories of impact—*Involvement and Enthusiasm, High-Quality and Innovative Work,* and *Prestige and Recognition*—work together as recurring, interactive, and generative. At many levels and in many instances of arts integration, people get excited about it, the quality of the work changes, and the work gets attention and recognition. The causal relationships among these impacts are multi-directional: prestige and recognition get people excited about arts integration, the changed quality of the work leads to prestige and recognition, the quality of the work changes because people are involved and enthusiastic, and so on. Furthermore, these three impacts work together, leading to dissemination and visibility and, in turn, to more and stronger arts-integrative initiatives. They are an engine that drives creative collaboration.

Notably, interviewees refer to these three ideas not only as impacts of arts integration, but also as benchmarks of the success of arts integration. They are, in fact, the most frequently mentioned benchmarks of success.

Chapters 5-7: Impacted areas

With an assumed starting point of arts integration in the university, impacts are felt first within the university itself—on teaching, research, the institution, and the disciplines (Chapter 5). These impacts flow to the students (Chapters 6). The students become agents of impact outside the university, but there are also other direct impacts on the world beyond academia (Chapter 7), often because of publicly engaged scholarship.

Chapters 8 and 9: Measurement

While measurement for impact is not consistent across arts-integrative initiatives, certain benchmarks and instruments for measurement do recur in interviewee accounts. Benchmarks include participant involvement and enthusiasm, prestige and recognition, and continued effect. Interviewees most frequently report using surveys and other "feedback"—both formal and

informal—as instruments to measure impact. The types of evidence interviewees include in their accounts also provide implicit means of assessing impact.

Methodology

The insights in this report are based on responses to Questions 25 and 26 (Q25 and Q26) of the a2ru SPARC (Supporting Practice in the Arts, Research and Curricula, funded by the Andrew W. Mellon Foundation) interview cycle, which took place 2012-2015. Interviewees included upper-level administration, faculty, and students at 38 a2ru member institutions.

> What impact did you hope to see? What impact did you actually see and how did you measure it? (Q25)
>
> How have these programs affected your teaching and research? What about your colleagues' teaching and research? [and variations of this wording] (Q26)

The interviews were recorded and transcribed, and a2ru staff parsed and cleaned the transcripts. There were 212 individual responses to Q25 and Q26 in which people talked about a range of experiences—from awards and recognition for innovative research, to strengthened student communities, to sensory gardens for the blind.

From these responses, we tagged every instance in which an interviewee identified an impact of their arts-integrative work and, in the service of distilling this large data set (273 examples), applied a bottom-up coding process. We grouped similar types of impact together, eventually developing a taxonomy of major categories of impact. Since most interviewees did not distinguish between intended and actual impacts, this data set becomes a catalogue of "possible impacts."

We found that the major categories we had identified differ in *type*. Some center on the object of impact, such as "impact on the community" or "impact on research," and some seem more action-centered, such as "generates involvement and enthusiasm" or "promotes community and collaboration." To make sense of the data, we constructed roles for and relationships among the categories, generating an organizational structure that is fully represented in the comprehensive report on impacts and in the graphic map of impacts, and partially represented in the shorter, targeted reports. Our sense-making, as articulated in this structure, is, of course, inductive and subjective; there are alternative ways of telling the story of this data.

We expanded our impacts taxonomy with a literature review, and we incorporated an additional data set of ~4000 undergraduates' survey responses about their experiences of the arts at the University of Michigan, including impacts, precursors, barriers, frequency, and perceptions of co-curricular arts engagement in college. Drawing from a subset of open-ended questions and responses, we created computationally driven topic models for each question and an interactive decision support tool to facilitate collaborative interpretation of the topics from the results. We also measured a variety of linguistic, rhetorical, and psychographic factors associated with the responses using three different dictionary-based tools. We then combined these measures with the measures of topic prevalence in a principal components analysis to explore the relationships between the topics, tone, and structure of the responses. The results — particularly when coupled with an analysis of their relationship the demographic profiles of the respondents — provided important insights for the design of arts-based experiences in higher education, as well as the impacts of the arts on student learning and

engagement. Many of the resulting topics were integrated into the overall impacts ontology. Details on the methods and results of this work is in preparation.

In this second phase of our research, we sought broadly to substantiate and expand on what we had found in the SPARC interview data, expecting to add new types of impact to our taxonomy and possibly revise the relationships that we had sketched among impacts. We also specifically looked for negative impacts of arts integration because we suspected that the study sample had led to an over-representation of positive impacts. People participated in the interviews *because* they were involved in arts integration in the university. As such, they were likely motivated by a deep commitment to arts integration; quite possibly, they occupy a somewhat counter-cultural space in their department or institution because of the current vanguard status of arts integration in the university. Their inherent commitment, coupled with the possibility that they might often find themselves advocating for or defending arts integration, suggest that when talking to an outside interviewer they would be inclined to emphasize its positive impacts. Indeed, only two of the 273 examples of impact in our initial taxonomy were negative. Recognizing that this is an unrealistic representation, we intentionally looked for negative impacts as part of our literature review. We eventually focused this search on the high-level categories of impact *New Perspective, Understanding, and Awareness* and *Working Together*, although negative impacts also surfaced in other areas.

As a result of this NEA-supported supplementary research, our taxonomy gained new categories and examples of impact. However, readers should note the difference in process between the SPARC research and this supplemental research, and how it manifests in these reports. The original, interview-based research followed a bottom-up process, in which examples—quotations drawn from interviews—formed the foundation. We gathered together examples that were similar in type, and these eventually formed sub-categories, which coalesced into categories. By contrast, with the literature review, we sometimes found categories of impact suggested by research that didn't have accompanying examples (a more top-down approach). Because of this, the reader will notice that some categories of impact are rich with real-life examples while others have theorizing but no examples. Both types serve the goal of the taxonomy—to describe the rich landscape of impacts— even though the narrative representation varies.

In addition to contributing new categories and examples, our supplementary research prompted us to remodel some of the relationships among impacts that we had constructed for our taxonomy, especially around "the dynamo" (see Chapter 4, below). Our supplementary research also led to "discussion" sections in which we explore in depth several of the topics that are particularly important to those practicing arts integration in the university. Finally, support from the NEA enabled us to sound our taxonomy with other university professionals, whose questions and comments at online and in-person workshops informed the shape of our research.

This report focuses mostly on the impacts themselves (Section I), with only modest attention to the question of measurement. Because questions of aspirational and actual impact were bundled together with the question of measurement, it was often difficult to disentangle the speaker's answer. For example, when some interviewees speak about publishing in a prestigious journal, it is ambiguous whether they consider such publication to be the impact of arts-integrative research, or whether acceptance into the journal constitutes a benchmark (measurement) of impact. Furthermore, because measuring impact is a difficult process, often not formally undertaken, many interviewees did not address the topic of measurement at all. Those who did address it referred to both *benchmarks* and *instruments* for measurement. Because of the ambiguity of the data, this report

simply gives an account of both types of response, leaving the investigation of measurement of impact as a topic for further research.

A note on citations:

- In-text citations of literature refer readers to a reference list at the end of each chapter.
- Examples from the SPARC interview data have an in-text citation indicating the unique identifier number of the quotation, but do not appear in the reference list. Each identifier has a prefix that begins with the letter "Q" and a number, indicating the question to which the speaker was responding. Readers who are interested in the context for these examples can visit https://www.sparc.a2ru.org/insights/questions where all the study data is available.
- Examples from the U-M Arts Engagement study also have an in-text citation but do not appear in the reference list. These examples do not have unique numbers and are identified only by the question to which the speaker was responding. The first time a response to a particular question appears, its in-text citation gives the full text of the question; subsequent examples that respond to that question are identified by a shortened form of the question. For example, "UM-AE: In what ways do you think you can grow through the arts?" becomes "UM-AE: Grow."

Data Sample Information

SPARC data

The 155 interviewees who responded to SPARC interview questions 25 and 26 were primarily faculty (79%), but also included those in leadership roles at the Director, Dean, and Provost levels (17%), as well as other staff. Notably, half of those who identify as Professor also serve in leadership roles:

Professor or Assistant/Associate Professor (faculty) (72%)	112
(Professor who also serves as Director, Departmental Chair or Head, Dean or Associate Dean, Provost or Associate/Vice Provost, or Vice President: 56)	
Program Director (leadership) (10%)	16
Instructor or Lecturer (faculty) (7%)	11
Dean or Associate/Assistant Dean (leadership) (5%)	7
Provost or Associate/Vice Provost (leadership) (2%)	3
Arts Specialist (1%)	2
Curator or Librarian (1%)	2
Community Engagement Specialist (.5%)	1
Student (.5%)	1

Eighty-eight per cent of those interviewed worked at Research 1 or Research 2 universities, with the remainder at colleges and universities with larger Master's programs, arts-focused four-year schools, and universities with very high research activity.

Interviewees represented disciplinary clusters as follows:

Music, Theatre, and Dance (27%)	42
Fine, Contemporary, and Media Arts (21%)	33
Engineering, Design, Information, and Architecture (18%)	28
Humanities (15%)	23
Natural Sciences and Medicine (10%)	16
Social Sciences, Education, Business, and Law (8%)	13

Arts Engagement Data

University of Michigan undergraduates responded to a series of questions about the arts in their college experience. This report draws on the following questions from that survey:

"In what ways do you think you can grow through the arts?   n=971

"How did your involvement in the arts during college make you feel?"   n=1207

"What role did the arts play in your development as a person, friend, colleague, and student during college?"   n=840

What do you see as the barriers preventing you from being involved in the arts at the University of Michigan (if you experienced any)?)   n=3857

Section I: Impacts of Arts-Integration and Interdisciplinarity

Section IA: High-level Impacts

In our analysis of arts integration in the university, we organized categories of impact into a structure, wherein the categories have relationships to each other. While that structure is more cyclical than linear, in narrating it here, we need an entry point—a beginning for the story. Our account of the impacts begins then with the convergence of two forces, or concepts: the arts and interdisciplinarity. These are the component parts of arts integration. The immediate result, felt by those participating in arts-integrative teaching, research, or community engagement is similarly twofold:

- Participants in non-arts disciplines feel the presence of the arts. We can call that phenomenon "exposure to the arts" if we allow that somewhat reductive shorthand to account for the way experience changes when the arts are in the room.
- Diverse thinkers come together. This foundational aspect of interdisciplinarity is the other key piece of arts integration; there is broad functional and conceptual diversity.

Two broad categories of impact, *New Perspective, Awareness, and Understanding* and *Working Together,* emerge directly out of this arts-integrative situation. It is important to note that these impacts are pervasive and recurring; they are active wherever arts integration impacts are felt—on a specific discipline, in the classroom, or outside the university entirely.

Chapter 1: New Perspective, Understanding, Awareness

This category of impact has multiple sub-categories, many ways in which the main idea is refracted or manifests in slightly different ways. What these concepts have in common is the idea of encounter with something unfamiliar—not just unfamiliar concepts, but unfamiliar ways of thinking about concepts.

Such an encounter with new perspectives, practically by definition, constitutes fertile ground for learning. One broadly accepted theory of learning stipulates that, cognitively, we structure knowledge into schemata or frameworks of understanding. When presented with new information, we either *assimilate* it into these schemata, or we modify the schemata to *accommodate* the new information. (Piaget, Piery, and Berlyne 1950; Sternberg 2002). The notion of accommodation implies that, contrary to an additive view of learning wherein we have a bank of knowledge to which we add new chunks of knowledge, acquiring new knowledge changes the knowledge that was already there. We must re-examine what we thought we knew in light of the new, with the possibility that it will need to be taken apart and rebuilt. Where, for example, science and the arts are integrated, we find this sort of conceptual de- and reconstruction. In many sample cases, scientists and artists not only learn about each other's fields, they reconfigure what they know about their own fields, based on the other's perspective of it (Gurnon, Voss-Andreae, and Stanley 2013; Jeffries 2011; Stevens and O'Connor 2017; Tambiah and Lamberts 2011.

The category *New Perspective, Understanding, Awareness* is notable then for several reasons. It refracts into many related but distinct experiences; it recurs across the impacts landscape, affecting a wide range of people and practices; and it coincides substantially with learning in general.

Big-picture Perspective

Through the encounter with difference inherent in arts integration and interdisciplinarity—working with people from disparate disciplines, in perhaps unfamiliar modes—people gain a newfound understanding of the "big picture." (The "Big-picture perspective" subcategory of impacts could just as easily be grouped under the *Working Together* category rather than the *New Perspective…* category.) They acquire a more expansive sense of the world or of themselves, which some see as an integral part of a university education. This broader perspective can be undefined, or can specifically entail thinking beyond the limits of one's own discipline. All of these experiences have as their prerequisite a willingness, an availability, an open mind.

Broader perspective

- "With my outreach project, for example, it started out as attempting to give my students something that gave them some perspective." (Q25-2113-528)
- "The impact that I was hoping to see was that students have a very broad understanding of what it means to be an educated, good human person." Q25-1401-4413)
- "If we're not titillated by certain types of textures and things, if we don't understand those things, we don't have a real understanding of the world. If arts aren't integrated into education, how are people going to have a broad sense and true understanding of the world?" (Q25-1401-4416)

- "Arts have always been a part of the general education requirement, so the university sees that appreciation of getting a broader-based view of the world." (Q25-4002-6530)

- "The arts can expand your thinking by increasing range of knowledge and allowing one to evaluate more opinions." (UM-AE: In what ways do you think you can grow through the arts?)

Beyond disciplinary boundaries

- "It's more of a long-term thing, in terms of getting people to think outside of their narrow discipline and getting them to think a bit more broadly." (Q25-4019-6875)
- "We have to constantly challenge what our built and visual environment means to the health of a society, to the advancement of a society and culture." (Q25-3804-1072)
- "You know artists who don't know about literature or haven't read novels or haven't read poetry, who haven't travelled to foreign countries. And lots of those kinds of things students are introduced to at the university. Then they come to realize that thinking about a structure of a novel could be like thinking about the narrative development in a piece of sculpture." (Q25-3605-8049)
- "It definitely has helped me to see the decision makings for teaching, or to make choices in a more holistic way, or to see that from a different perspective than only from a certain discipline perspective" (Q26-2617-3860)
- "I expected more people to understand that arts and science are connected...If we transform this building, it would be great that other people just by walking through, without teaching, gain the awareness of art and science." (Q25-2515-5205)

Open mind

- "I think the arts will help me to stay open to new ways of thinking and new experiences. To me, the arts are a reminder that life does not have to be mundane or routine but can be sublime and wonderful as well." (UM-AE: Grow)

- "I'm a civil engineer and often spend the majority of my time thinking analytically and technically. My exposure to the arts has been a nice contrast, opening up my mind to a whole new way of thinking/expression." (UM-AE: How did your involvement in the arts during college make you feel?)

New Understanding and New Thinking

The arts-integrative or interdisciplinary encounter with difference also imparts new knowledge, which in turn can change ways of thinking.

New understanding

- "I'm also interested in new lucrative ideas and knowledge. I'm a voracious learner and...I feel like it's [collaboration] an expansive way to learn about the world." (Q25-3002-4554)

- One goal of a course is to have students understand frequency content of sound, and extend this understanding to other areas, including electronics and radar. (Q25-3406-769)

Thinking differently

- "The lab feeds my interest. I learn more things, I try new things; I make things differently because of it. I see the world differently." (Q26-3002-4560
- "I like to take content that I don't know very much about, that I can really study in a variety of different ways, and see what happens to my creative process when I bring that into it and try to make something with it." (Q26-3705-8321)
- "It just gives you a broader mindset and makes you think about things in many different ways." (UM-AE: Grow)

Refreshed thinking

- "It mostly affects my research by allowing me, in my very quiet moments during the semester, to question and alter the way that I think." (Q26-4025-7039)

Frame familiar problems in new ways, challenge habits and certitude

This category was suggested by the report *Art as a Way of Knowing* (McDougall, Bevan, and Semper 2011), and some of the SPARC examples fit well with it.

- "I started reading a lot of books that are outside of my realm, and then what they say about creativity is I put together things that you wouldn't think that they go together. I guess in that sense, I have become a bit more of a risk taker [in my research]." (Q26-2501-4984)

New Experiences

Perspective and understanding are not only products of *thinking*; they are deeply affected by *doing*. The embodied experience of arts integration contributes significantly to its impact, most noticeably when participants develop an explicit appreciation for that physical experience. Alternatively, these experiences can lead to new acquaintances; people get connected to more and different kinds of other people, which in turn leads to more new experiences.

New experience

- "[My course gives students] an appreciation for the challenges of physically making things, especially in the digital world…For example, a couple of years ago, I was teaching Vector Calculus—a whole class of engineers, and I said lightheartedly, 'We're going to have cake because it's relevant for integrations about slicing.' You get a round cake and a rectangular cake, and of course you slice a rectangular cake into rectangles and the round cake in wedges, and then you make a point that if you're integrating over a sphere you want wedges. Anyway, so I just said, 'We'll have cake,' and they said, 'Cake? Why?' So I said off the cuff to one of the students, 'You can make the cake,' and this is a 20-year-old engineer, and he said, 'I can't make cake.' I said, 'First of all, you can buy the box, and

second of all, the joy of cooking exists for people like you.' I thought that was very odd: well, here's an engineer, he's going to be building bridges. Can't bake a cake." (Q25-2909-1499)

- "We can teach tons of people how to use a 3-D printer. A very small percentage will successfully pursue that and do interesting things, do things beyond downloading files and printing someone else's stuff….if you leave it to a couple of newspaper articles to sum up what 3-D printing is, it's transformed in some way that's not experiential. When you perceive it, if you don't have a first-hand experience with it, you can't engage that conversation intelligently, other than what someone has told you to say about it, based on the group that you're already supposed to be in." (Q25-2411-4113)

Appreciation for the physical world

- "I have asked them, 'Why does art history matter' and their answers are fantastic because they talk about how the art object offers a materiality to the exploration of historical events." (Q25-3604-8027)

Connections to other people

- "There are just so many people out there. [My collaborator] knows people at Smithsonian that have these huge archives of all the stuff. So he has grants we're hoping to work with my computer science colleagues on... and get this information out to a public with maybe an exhibition at a science museum." (Q26-3704-8293)
- "I will also be able to meet new people that are different from the traditional business people I always hang out with and they can give me a different perspective on things." (UM-AE: Grow)

Engagement with the Arts

Because of arts-integrative and interdisciplinary initiatives, the arts spread out to the world in unconventional forms and unusual places, and as a result, a greater number of people come into contact with the arts. The line between the "exposure" to the arts invoked at the beginning of our story and the "engagement" we see here is a blurry one, but we believe that they are both valid impacts. We also use the old-fashioned "arts appreciation" here, as a way to infuse the contemporary idea of "arts literacy" with a sense of respect and love.

Engagement with the arts

- "The number of people outside the School of Music who are participating also increases. The re-invitation rate is super high; it's somewhere between 95 and 98 per cent. The number of kids that we reach each year rises." (Q25-4206-908)
- "I would hope to see more of that happen, and more people get a chance to enter into the process of becoming more musical, wherever they are in their lives." (Q25-2914-1579)
- "In the five years that I've run the film festival...we've almost tripled our attendance during that time. I just think it has been great partnerships within the community so that you broaden your audience base." (Q25-1306-7145)

Appreciation for the arts

- "There's also a selfish motivation in the desire to broaden audiences for our art form. I always feel that any opportunity you can simultaneously reach somebody with this idea and also introduce them to the beauty of chamber music, I'm all over it. (Q25-2307-5914)
- "The more one is exposed to the arts and culture, it is a currency. It is a currency that will show up for the rest of your life. No matter what classes you take, no matter where you travel, arts will always come into conversation." (Q25-2404-3988)

Promote Cross-Cultural Understanding

The encounter with difference that is inherent in arts integration not only raises awareness of other cultures; it also becomes a means through which other cultures can be understood.

- "I've travelled in the country music world and heard this song sung at bluegrass festivals by all-White bands, and heard them talking before and after. And that's my proof that, actually, it got people talking about this thing [lynching], it got people acknowledging this part of the history." (Q25-5201-7803)
- "What we hoped to see was people feeling more comfortable--and what I mean by 'people' is students or any of the participants in the presentations they offer—feeling more comfortable to engage the issue [of diversity]." (Q25-3914-7558)
- One study incorporating arts-based pedagogies into a graduate program in TESOL (Teaching English to Speakers of Other Languages) demonstrates a heightened potential for students "double vision," creating vibrant Eastern-Western exchanges of intellectual thought and intercultural understanding (Cahnmann-Taylor et al. 2015).
- "The arts offer a new lens with which to view different people's experiences and perspectives, and getting a glimpse through that lens can only offer more knowledge about the world and all the people in it." (UM-AE: Grow)
- "You can broaden your horizons and come to appreciate people with different talents and interests, as well as the lives people live in other cultures (even within the same country)." (UM-AE: Grow)

Negative Impacts

SPARC interviewees refer to new perspective and working together as entirely positive phenomena, ones that are pleasant and yield good results; no negative impacts in the category *New Perspective, Understanding, and Awareness* emerged from the SPARC interview data. This focus on the positive is probably a function of the sample demographics; most interviewees participated in the interview cycle because of their investment in arts integration at their institution, and would be unlikely to cite negative impacts in this context. In an effort to provide a more realistic representation, we deliberately sought negative impacts of *New Perspectives* and *Working Together*. Through our literature review and a review of interview responses to other SPARC questions (especially Q17, Q18, and Q19, which deal with challenges of interdisciplinary collaboration), we surfaced several negative impacts, which are included in this section. These negative impacts are real potential consequences of gaining new perspective or awareness, and of working with people whose practices and

conceptual backgrounds differ considerably. They can be considered "pain points" in arts integrative practice, and can shut down the process entirely. However, an awareness of these negative impacts affords potentially richer experiences for those involved. Because the *New Perspective* and *Working Together* impacts resonate across the student experience, collaborative research, co-teaching, and the communities with which the university interacts, it behooves us to understand their power as well as their potential challenges and disadvantages.

Upset worldview, knowledge structure, and values

The literature on education and psychology shows that the conceptual change required in order to take on a new perspective or embrace a new understanding does not come easily; there is associated dissonance and discomfort.

Part of the discomfort is rooted in demands on cognitive economy. Conceptual change is "expensive"; it's difficult to restructure thoughts, and especially so when new concepts are contrary to intuition and habitual ways of thinking. Maintaining the status quo is preferable (Campanario 2002, 1097), whether the new concept is a scientific one or an artistic one; the new perspective that arts integration promises doesn't necessarily come easily or naturally.

New ideas are also risky because they represent disturbances to familiar routines, network relationships, power balances, and even job security (Albrecht and Hall 1991, 274). In fact, we are likely to prefer information that confirms the concepts we are already invested in; taking on new ideas can imply threat to our self-esteem, feelings of being overstrained by high decisional complexity, and associated negative moods (Fischer 2011, 752). Fully adopting a new perspective requires us to rigorously reexamine deeply held values, beliefs, and assumptions (Powell and Kusuma-Powell 2015). This process may be too demanding, leading some to experience the encounter with difference as unpleasant.

Cognitive reframing and upset worldview can be steps along the way to new perspective and understanding, but the dissonance and discomfort associated with them can also stop the process of conceptual change. Then these negative impacts become the end result.

Threat to identity

The ideas we embrace are part of our identities. Privately, we are emotionally attached to our ideas, so to abandon them can be painful. Especially in university settings where faculty identify strongly with a single department or field, the ideas they espouse constitute an important part of their public face. That face might be threatened by a new perspective (Albrecht and Hall 1991, 274). Indeed, new ideas that contradict the ones we hold dear threaten identity on both the private and public planes; if I take on a new perspective, I am not the person I was before. Therefore, it makes sense to reject "knowledge that threatens the self with disintegration" (Carson and Johnston 2000, 80) because even though such knowledge has the potential to be exciting and positive, it also creates dissonance and discomfort around our identities.

Non-comprehension

Whether the new perspective is that of art or of an unfamiliar discipline, there is always the chance that we simply won't understand. Non-comprehension can drive us to investigate further, seeking answers, but it can also lead to confusion, frustration, and alienation, as we have seen with some

students' initial encounters with experimental art. Then, disdain for and rejection of the new perspective are possible outcomes.

Offense

The affront that new perspective presents to our established worldviews can be so severe as to offend us, to make us feel that the ideas we hold dear are disrespected. For example, Andres Serrano's photograph *Piss Christ* offends those with certain views on Catholicism (Fishbein 2012). The perceived insult in offensive ideas not only turns us against those ideas, it also makes us feel attacked, resentful, and angry—a combination of effects that is unlikely to lead to further engagement.

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Chapter 2: Working Together

Like *New Perspective, Understanding, and Awareness, Working Together* is an impact of arts integration and interdisciplinarity that recurs in many contexts, within the university itself and beyond its walls. In the *New Perspective…* category, arts integration entails an encounter with different ideas, impelling us to reconsider what we already know—essentially, to think differently. Arts integration also frequently requires an encounter with different people—those with different knowledge bases, different practices, and different epistemologies. The imperative to work with diversity—in a cross-listed course, in an interdisciplinary research partnership, or in a collaborative project—is inherent in arts integration, and is represented here as the category *Working Together*.

The cooperation inherent in interdisciplinarity is itself a powerful impact; interviewees often talk about the phenomenon of people working together, and all of its nuances and implications.

Collaboration's capacity to bring together diverse minds is one source of its power, so initiatives that create networks connecting disparate individuals constitute a positive impact. It is also a positive impact when students learn the value of working with those from other disciplines, and their academic collaborations lay the groundwork for future collaborations. Interdisciplinarity has a positive effect on both the work being done and on the people doing it, often leading to better outcomes and stronger teams. It impacts social and cultural aspects of academia, too; where people are working together, community grows, and this strengthened academic community has benefits for students, faculty, and the institution. Finally, there is a lighter but not insignificant impact: working with the arts is fun.

Diverse thinkers work together

- "They post problems on the computers and anyone in the world can answer…The multiple minds from different places, I think, serve a great purpose." (Q25-4002-6530)
- "One of my goals with my interactive lab is to create a network of other labs and other clubs in other campuses. So I'm going to be starting a working group with a distance-based collaboration." (Q25-3002-4559)
- In one study, graduate students in art worked with engineering students on visual metaphor. The study found that "…seeing the problem in a different light led to multiple solutions, whereas, without this perspective there may have only been one solution or no solutions" (Costantino et al 2010, 52).

Lay foundation for future collaborations

- "The fact that they're still working together means that my course outcome of multi-disciplinary teaming and learning and exchanging from each other actually was met." (Q25-2907-1455)
- "There's been lasting relationships formed through the project where they're continuing to do work together now just on their own, which probably wouldn't have happened without some sort of catalyst to get the composers over to the Center and get them interacting with each other." (Q25-2917-1649)

<u>Stronger teams, better outcomes</u>

Supporting interviewees' accounts of the positive impacts of working together, the literature on computer and administrative science also indicates advantages to bringing together diverse thinkers. Computer science uses the concept of a distributed network to explain the power of collaboration: "As the examples of the scientific community, social organizations, the economy, and biological ecosystems show, a collection of interacting agents individually trying to solve a problem using different techniques can significantly enhance the performance of the system as a whole" (Huberman 1990, 38). Indeed, the most effective groups are not necessarily the high-ability ones, but rather the ones that have high functional diversity—a broad range of ways to see a problem and to go about solving it (Hong and Page 2004). The interdisciplinary team corresponds to the system with high-functioning diversity; we can expect it to be strong and to produce good outcomes.

<u>Creating academic community</u>

Program brings people together to create a strong community

- "This hypothesis was that the arts can reach this deeper level of passion, especially among the long-term stewards of the institution, and bring people together to start to imagine what we could do together. And I feel the project really did that." (Q25-3001-4530)
- "I think they [the program founders] were looking to find community in some interesting way, to give students this opportunity to live amongst each other but have some kind of shared connection, and that being the programs themselves." (Q25-3103-6155)
- "It wasn't so much they [students] took away from the experience, 'I learned so much more about arts, I appreciate so much more.' It was really more about this kind of growth, their own personal growth and their own understanding of what it means to be involved in a community...kind of thinking more about themselves, about how they connected with each other. And to me that's a great success." (Q25-3103-6159)

Undergraduates are drawn into the field

- Faculty use undergraduates as research assistants. (Q25-3803-1054)
- A program goal is to inspire student participation in the field, and one faculty member cites a number of successes among the undergraduates. (Q25-3401-696)

Community supports more collaboration between faculty and between departments

- "Those of us who are involved in teaching in this area are gradually over time finding where we can support each other." (Q26-3705-8322)
- "The general spirit of collaboration between departments does seem to be more present in the school the longer I stay here." (Q26-4116-2991)

Fun

Interactions with the arts can provide an element of fun not always found in research and teaching contexts.

- "What was fun was both groups really wanted to understand where the other group was coming from. So we had a nice dialogue, and she showed us some video clips of some of her dancers and explained what was going into that, and then we explained to her what our particle physics experiments were about. That was a lot of fun." (Q17-5201-6026)
- "And I think that's the biggest thing that we set up for ourselves in the arts. It's like we own a bowling alley and we set up the pins; we say, come on, knock them down…Well, there was no one who could not be engaged by this music circus. They were delighted. It appealed to go back to that sandbox, to come play in the sandbox." (Q25-5203-7840)

Negative Impacts

None of the interviewees responded to questions 25 and 26 with an account of some negative impact of working together. Nonetheless, we know that when faculty and students from different disciplines collaborate, many things can go wrong. We include some of those negative impacts here; they are drawn from our literature review and from responses to questions 17, 18, and 19 of the SPARC interview cycle, which asked about challenges to collaboration. Some of these negative impacts stem from the differences among collaborators, while others are rooted in the institutional challenges of collaborating with someone from a different department, school, or college.

Increased conflict

Alongside their potential effectiveness, diverse interdisciplinary groups have a considerable potential for conflict. This stems from the reality that they are often diverse in several ways; in a university collaboration, there may be social category diversity (university and non-university employees, instructors of different rank, graduates and undergraduates), value diversity (what constitutes an acceptable research product? what is valid evidence?), and informational diversity (the range of domain knowledge) (Jehn, Northcraft, and Neale 1999).

- "There can be very different expectations for what is a coherent or useful deliverable out of the work." (Q17-2102-294)
- "He is an award-winning civil engineer and does great studies and whatever, but there was sometimes a disjuncture between my desire to be imprecise and talk about paradoxes and to find the problems, and his desire to, 'Okay, what's the answer? How can we formulate it? Where will we put it into its particular category?'" (Q17-2820-3441)

Increased misunderstanding, difficulty communicating, decreased commitment, high attrition

In addition to increased likelihood of conflict, diversity on teams increases the likelihood of several negative impacts, including increased misunderstanding, difficulty communicating, less trust, lower commitment (and a resulting higher attrition), and a lower perception of group fairness, (Roberge and van Dick 2010, 297-298). Some aspects of the collaborative project over which group members

may have little control—such as time, task complexity, degree of empathy and support from authority—affect the potential for these conflicts to arise. However, group members can prepare for and directly address some of the other aspects of collaboration that reduce conflict by, for example, establishing common goals and ensuring equal status within the group situation (Roberge and van Dick 2010, 298-304).

- "Yeah, certain personal agendas [were a barrier to collaboration]. The idea that a certain way or method or theory is the only way, method, or theory. And certain personalities, certain backgrounds in certain disciplines, I think caused that [misunderstanding] to happen. I do not personally believe there is only a one way or theory or method in any of the areas in which I teach, but I have had difficulty with certain colleagues who do feel that way." (Q17-2617-3851)
- "It's more challenging, I think, with some of the humanists, or in the social sciences. I find when I collaborate with, say, natural resource economists that have their own language, we have our own language, sometimes it's a challenge." (Q17-1307-7158)
- "The way that an architect is trained is very different than the way that a fine artist is trained, or a fashion designer or a door designer. And they all have very different paradigms. And so in these classes they have to come together and negotiate that space somehow. It can't be my way or the highway or nothing will get done." (Q17-4701-2657)

Difference slows or shuts down project

- "I'd call it academic arrogance. My discipline is smarter than your discipline and I don't want to water it down. The physical geologists, the geographers, won't talk to the social geographers. The macro economists won't talk to the micro economists. The people in the Business College think they're a hell of a lot better than the College of Agriculture and vice versa. You have those petty differences that can be a show stopper right from the start." (Q17-2714-2219)
- "As long as we agree to work things out, that's okay. But there are also cases where you have to realize up front or at certain milestones that maybe we're better off going separate ways, but still go sit down, have a beer with each other. Happy, but let's not work together." (Q19-4016-6821)

Work on project is uncompensated, or doesn't "count"

- "And so something that I come up against very, very often is, for example, you can't get tenure. You don't get points, you don't get credit if you do collaborative work. You don't get credit if you do interdisciplinary work; nobody knows where to put it." (Q17-2001-4936)
- "The only option that I could foresee, or anyone could foresee, was taking an additional load. That's basically what I'm doing right now; I'm teaching an inter-disciplinary class with an art historian and arts. The only way I could teach that class was adding a class to my load…No [I'm not compensated]. I'm doing it because I believe in the class." (Q17-2601-3502)
- "I'm so heartfelt and passionate about bringing the different territories together that I end up, for example, volunteering to teach in the medical school…They've made it clear

there is no money to pay me but you know, if I want to do it, I can volunteer my time. Which I do because I think it's very important work to do." (Q17-3505-8537)

Excessive workload for participants

- "Mostly I just kind of did all the work. Not all, but a lot of it. Had just realized that some of my collaborators are fabulous intuitive people who can offer me a lot. They just don't understand research in the way I think of it. In terms of posing questions, pre and post testing, that kind of stuff." (Q19-2521-5303)
- "So now, instead of teaching one course, I'm co-teaching two courses. It's really a lot more work than teaching one course; because my one course, I'm in the classroom three hours a week with my students. The class I'm co-teaching, I'm there three hours a week, even though I'm only getting 50 percent credit. The other professor's there three hours a week. So if I'm co-teaching two courses, I'm there six hours a week in the classroom, instead of the three hours I would have been for my own class." (Q18-3501-8460)

Increased administrative load

- "Paperwork, paperwork, paperwork, paperwork, paperwork. I don't think it's any different for anybody, but that's part of the communication process….It's trying to build an understanding of those disparate personalities and approaches towards doing things. Just within the department of art, every person in here has a different way of approaching research and problem-solving. Within this rather limited, small group, we have all this variety. You can imagine what it's like when we go outside of it and bring it in." (Q17-2807-3282)
- "There's a lot of bureaucracy in the way, as you can imagine. A lot of people were like, 'What number are we going to give this course?'" (Q17-1708-2630)
- "For instance, once of the things that I found out was those programs had no budget code. Without a budget code, there is very little you can do. If someone gives you money, you can't even take it. One of the first things we did was to get a budget line set up." (Q17-2727-2474)

Increased requirements of time and money

- "It always takes more time, more energy, more effort to actually teach collaboratively than on your own and when you can just make unilaterally decision and just do things the way you think it's going to be right rather than having to council with a team of people, which is a great process but you just have to allow for that extra time that it does take." (Q17-5008-3138)
- "Well, I think you have to acknowledge that it probably is going to demand more resources than the standard course that you're offering. You have to make a decision. Do you value having courses like this at your institution? If so, then how can you make the resources available to facilitate this kind of teaching." (Q18-2002-4956)
- "I think it is very time-consuming. You have to not just understand your own field, you have to be willing to understand another field. You end up probably starting to study that field, which can be a challenge in bandwidth." (Q17-2703-2037)

Unsatisfactory process or product

- "I'm also very fearful that, exactly as we discussed this idea of instrumentalization, that in the rush to try and 'integrate' that we will lose the things that are important to artists. That is just too easy to have happen." (Q18-2505-5052)
- "It's just when you actually go to try and decide an experiment to research; whether or not you can try to come up with something that is satisfying to people on both sides of the fence, so to speak. So, for example, if you're trying to do a study of music perception in a way that takes into account the cultural differences in music; can you design an experiment that is realistic enough. The materials that you use are sensitive enough to the differences that the music colleges would find an interest in. It's not that they inherently opposed the idea. But they work with richly imbedded, contextualized musical situations and the scientists we work with very disconnected, laboratory-based musical experiences." (Q17-4418-4392)

Participants encounter lack of respect

- "I've found some interesting partners to work with, very smart people, similar interests, however their idea of collaboration was me helping them on their project. As opposed to us thinking about a problem that exists and collaboratively working towards a solution towards it." (Q17-1118-5617)
- "They truly don't understand the depth of the research—of arts research—and the role that arts play in multiple things. So, sometimes, there's that very unsophisticated understanding of the arts and it's, well, a little insulting. So, I have to be professional and explain it like a fifth grader, "Well, this is one approach, but let me just tell you..." And basically, a lot of the same stuff they've read in their PhD programs, I've read and my graduate students will read. I think it's just a misunderstanding or not knowing the two disciplines, which has created a little bit of a lack of respect." (Q17-4022-6967)

Resources are pulled away from departments

- "We have some really good partners, but we have other people who don't appreciate an interdisciplinary education. They often think that we're poaching their students because our students may want to reach beyond the traditional kind of disciplinary boundaries." (Q17-2406-4024)
- "You have to satisfy the people, your immediate colleagues first, and they may not like you doing what they might perceive as drawing energy out of the unit, particularly when there are scarce resources and people are competing for those. One of the scarcest resources being your time and your service." (Q17-2727-2474)

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Chapter 3: A Unique Way of Knowing

Having an aesthetic experience such as viewing artwork involves a separate and intentional way of perceiving, different from everyday perception (Cupchik et al 2009). For many, the arts represent more than a separate type of perception; they are a unique way of knowing—a manifestation of knowledge, knowledge creation, and knowledge application (Carayannis and Campbell 2015; Jochum 2015; McDougall, Bevan, and Semper 2011, 33).

That the arts are and have their own way of knowing—that musical knowing is distinct from knowing in history, in mathematics, in language, in medicine—itself constitutes a significant impact of arts-integration across the university. It implies an arts-based research—one that brings about awareness, values the pre-verbal, and is multi-sensory (Leavy 2017)—and an arts-based pedagogy (Hetland et al 2013). We can think about an arts-integrated project then as a vehicle that brings together several unique ways of knowing—those of the arts and those of other disciplines involved. There is also an argument that such a project achieves yet another, wholly unique way of knowing, a transdisciplinary hybrid blend of arts-plus-something (Joachim and Aiolova 2015). In either case—an arts-based way of knowing, or an arts-plus-something way of knowing—there is something new at the table for all the disciplines involved in an arts-integrative project. This is a high-level impact in that, like "New Perspectives" and "Working Together," it resonates across and pervades more specific areas of impacts, changing the nature of arts-integrated research and informing arts-integrated classrooms. Leaders invoke this impact when they point to arts integration as a way through "wicked problems"; the assumption is that where the arts and other disciplines collaborate, there is some new way of thinking, and of solving these problems.

- "Does experience in the arts change students' minds so that they can approach the world as an artist would? Students must be given the opportunity to think like artists, just as they should also be given the opportunity to approach the world mathematically, scientifically, historically, and linguistically. The arts are another way of knowing the world--as important as the other disciplines to our societal health" (Hetland et al 2013, 4)

- "They have a new way to bring students through their general education, which is looking at a cluster of courses which revolve around a certain topic, and the Arts are part of that. So in that way, it is interdisciplinary because it's looking at issues from multiple viewpoints or from multiple disciplines and how those together, perhaps form a new, a different knowledge or understanding of complex issues." (Q25-4002-6530)

- The University of Manchester supports collaborative research, including projects that allude to unique ways of knowing: "Artist researcher Daksha Patel, working with Professor Rebecca Elliott and Dr Alexandra Morgan, will undertake residencies in brain and lung imaging. She will experiment with drawing methods that respond to concepts of noise and signal in biomedical imaging. The project explores how science and art construct knowledge, and the relationship between biomedical images and perceptions about the human body." ("Collaboration Projects")

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Chapter 4: A Dynamo for Arts Integration

We have identified four broad impacts—involvement and enthusiasm, prestige and recognition, high-quality and innovative work, dissemination and visibility—that seem to have a unique role in the ongoing processes of art integration. We conceive of them together as a dynamo, an engine that perpetuates arts integration across different domains and at different elevations within and beyond the university. The impacts that comprise the dynamo reinforce positive engagement and outcomes through the arts, and suggest social, psychological, and material mechanisms of change. Together, they hint at a formal model or theory of change that can drive arts integration.

Three of the dynamo impacts (involvement and enthusiasm, prestige and recognition, high-quality and innovative work) appear in the interviews not only as an impact, but even more as a benchmark of success. That is, some interviewees observe that arts integration or interdisciplinarity generate enthusiasm, and conceive of that effect as an end result (*because of arts integration, people are enthusiastic*), while others conceive of it as a piece of evidence in the case, a way to measure or prove that an arts-integrative initiative "works" (*we know arts integration is effective because we see how enthusiastic people are*). In fact, these dynamo impacts comprise three of the four benchmarks most frequently mentioned in the SPARC interviews. Taking into account the frequency with which involvement/enthusiasm, prestige/recognition, and high-quality/innovative work come up, as well as the flexible way that people perceive these effects (as impact or as benchmark for impact), we posit that these impacts play a critical role in arts integration.

Involvement/Enthusiasm

Sometimes the most notable impact of a program is that it gets people excited; it generates interest and makes them want to become involved with the class, program, or discipline.

- "It's a particular class, very demanding. Some students love that. Some students say, 'This is exactly what I came to [this university] for. I thought every class was going to be like this." (Q25-2119-654)
- "I give a lot of talks across the country, and many to lay audiences as well as at universities, and I get a lot of feedback that people find it very interesting, if not therapeutic, to listen to what the brain's doing when it's anxious so that they can evaluate their own anxieties." (Q25-3401-696)
- "Are the students really engaged? My students will stay an hour or more after class. It's typical after a two-hour class that there'll still be people here after [another] hour. It might not be the whole class, but a handful of people might still be here talking to each other. To me, that's remarkable. They are still engaged with things. I guess I measure success more in those kinds of ways that there's enthusiasm and engagement." (Q25-1319-7335)
- "We were once planning with three or four faculty and now we are forty-, fifty-deep, in this span of a couple years." (Q25-3701-8233)

<u>High-Quality and Innovative Work</u>

One of the key assumptions of arts integration is that it changes the quality of the outcome, be it research or student learning. Here, "quality" is sometimes associated with excellence (a student-produced video is high-quality) and sometimes associated with particular characteristics (the qualities of innovation and integration emerge as important in the interviews).

Excellence / High Quality

- "One of the student teams wanted to do a video. We worked with the place for the Center for the Study of Political Graphics; and we just finished a video for one of their fundraisers. And it was really quite successful, and in fact this was the best fundraiser that they've ever had." (Q25-4701-2655)
- "We have worked collaboratively together on many, many projects and presented them in various performance venues around the country, and met with positive professional outcomes based on that collaborative work." (Q25-2002-4952)

Innovation and Integration

- "I think some of the work we're doing is on the edge enough or advanced enough that there isn't a lot of literature for us to refer to, in terms of scientific research or background or publications. In many ways, I think we're forging our own path." (Q25-3101-6082)
- "Certainly in the final product of what the students present, you can see right away what kind of collaboration went on, and the success of the ideas…I would say that the projects have been really successful in the kind of experimentation and exploration that has gone on, and the progress that I've seen from their initial ideas to the final implementation." (Q25-2111-479)
- "We saw that there was a great hunger amongst the students to work collaboratively across disciplines. And so the kinds of outcomes that we've been happiest about...the work that students are producing is integrated to a much greater extent that it had been prior to that." (Q25-2002-4952)

<u>Prestige and Recognition</u>

When the quality of the work that comes out of arts-integrative initiatives is remarkable, it draws attention and garners prestige. Sometimes prestige functions by way of association, as when artwork and sculpture are featured in the headquarters of a large company run by an alum. Sometimes prestige takes the form of awards or other recognition from an outside source, but recognition from within the university is also a marker of prestige. Perhaps reflecting a perceived hierarchy of disciplines, instances when arts initiatives claim recognition and respect from the sciences are mentioned in particular.

Association with prestige

- A well-known writer talks publicly about his experience at the university. (Q25-2405-4007)

- "It's a family-owned business, but we're talking big time oil and gas with [this alum]. You walk into his office on the top floor there in town, the front office and everything, you think you're in an art gallery in New York, how much it means to him." (Q25-2405-4007)

Acclaim

- "The mayor is all excited about the work that we're doing." (Q25-3104-6177)
- "We have undergraduates in the last fifteen years who have won every single prize known, Pulitzer, National Book Award, National Book Critic Circle Award." (Q25-1301-7064)
- "I had regular meetings with the Dean of the college...We were telling them, 'Hey, we're doing this [performing arts initiative].' They're very supportive of the whole thing." (Q25-2917-1649)

- "We sort of have a hiring day when everybody can come. Suddenly they [big corporations] want to come on a different day, because they want sort of a little earlier…That's a measure of industry's desire. They're paying full moving packages for the students, and it's a real strong recruiting push to sort of bring these people into, I'd say, the premier areas in the industry. Clearly the tech giants, the Googles, Microsoft, Apple are all coming." (Q25-2108-429)

Respect and recognition from science

- "We hope to see world-class, prominent scientists begin to embrace what the arts can do for their science, and therefore for our whole society...Yesterday, we also had a Communicating Science workshop, organized by a professor of the theatre department. And I was very pleased to see one of our most, I would say, geeky virology faculty members, world-renowned, top of his field, National Academy member, spend two hours—which for him was a lot—at this workshop about using improv to communicate science." (Q25-3915-7537)

Dissemination and Visibility

Similarly, when the fruits of arts integration and interdisciplinarity—be they research findings, artworks or performances, or new products—are disseminated, impact spreads. They may reach a targeted audience, such as the readership of a scholarly journal, or the general public, but in some way the sphere of influence becomes broader. Furthermore, dissemination of results or end-products heightens the visibility of arts-integrative and interdisciplinary processes themselves.

- Student designs get exposure on a website. (Q25-4018-6855)
- "I am able to disseminate what I find to a broader faculty population. And I work with them after they are introduced to these strategies and integrating them into their existing curriculum." (Q25-3803-1055)
- "We foresee, and what we put in our proposal is, a unifying synthesis article about the topic, and input from all of these [collaborators]. That, we imagine publishing in sort of a broad, probably science journal like *Bioscience* or *American Scientist*, something like that. And then we

anticipate that there might be any number of articles that would be published in the disciplinary journals...I would report in the forest ecology journal, and the macroeconomics guy would publish in the economics journal." (Q26-4001-6507)

- "Then we plan to make a short video that would address this idea of this being a model. And so this would be distributed via the website of the Vice President for Research, and the university website. It would be sort of a primer, or a tool kit idea showing how did I go about [this process]." (Q26-4001-6507)
- "They do interviews with us and do articles about us in the industry journals, the smaller publications that are reaching writers and artists." (Q25-1114-5554)

Section IB: Impacts on Specific Areas

New Perspectives, Working Together, Involvement and Enthusiasm, and the other recurring impacts described in the previous chapters all pervade areas like research, student experience, and the world beyond the university. However, these areas also feel unique impacts of arts integration and interdisciplinarity; these impacts are explored here.

Chapter 5: Impact on Academia

Impacts are felt perhaps most immediately within the university, where arts-integrative initiatives are taking place. While these impacts quickly flow beyond the university, carried by alumni entering the employment market, dissemination of research, and community engagement projects (to name just a few agents), this chapter centers on arts integration's direct effect on teaching, research, and the institution itself.

Note that the high frequency of references to impacts on teaching and research is at least partially attributable to the existence of a discrete interview prompt (question 26) asking specifically about impacts on these areas.

Teaching

There are several ways that interviewees described arts integration and interdisciplinarity affecting their teaching. Co-teaching a course affords faculty the opportunity to learn from colleagues, borrowing strategies and approaches to broaden their own teaching styles. In addition, faculty members' participation in arts-integrative and interdisciplinary research can affect their teaching: course content and student experience change when elements of research find their way into the classroom, and roles of teacher/student blur with roles of co-researchers and thereby change the classroom dynamic. Finally, the literature describes a range of pedagogical impacts from integrating the arts into non-arts classrooms. Note that much of this literature is built on research in the K-12 population; nonetheless, these impacts are relevant for higher education as well.

Co-teachers affect each other's teaching

- "I thought I could learn something from my colleagues...not just at a content level but also at a pedagogical level." (Q25-5209-7942)

Faculty bring elements of their research into classroom

- "Working like that has had a huge impact on how I teach because I want my students to have the real experience of making something from scratch." (Q26-3705-8321)
- "I find myself in classes talking about my research projects and try to link it to whatever we're talking about in class." (Q26-5203-6059)
- "I have a course in that topic area and...if I do have a research question, I'm beginning to explore students who can begin to do it [think about the research question] there." (Q26-3710-8421)

Change in classroom culture

- "The students are very interested in class to see what it means to take it beyond the confines of the classroom, and that I'm doing this. There is this kind of feeling that, we're all in this together. I'm not quite sure where we're going, but everyone's very excited about it." (Q26-2102-300)
- A report on the progress of a high school-level arts integration program finds that the program "…fostered motivation and engagement, and established a positive climate to a greater extent than the traditional classroom" (Dorfman 2008, 55).

Pedagogical impacts

Reach different types of learners in different ways

- Arts integration has its most powerful effects on achievement among students with lower socio-economic standing (Rabkin and Redmond 2006, 1).
- "Arts learning is participatory and active and requires students to interact with content and materials using both their bodies and minds. This way of learning engages students by offering them many ways to gain understanding and express their knowledge." (Duma and Silverstein 2014, 5)

- "I think that there are opportunities through art for people to see visually, kinetically, connections that if they hear it described to them argumentatively they won't get. Some of us are really quick conceptual thinkers and some of us have concepts that grow out of the way we see something come together. I do think that arts integration is a way that provides an opportunity for people who have difficulty." (Q25-2911-1531)

Increased use of active learning strategies

- The author of one study into the effects of arts-integrative teaching notes that such teaching may contribute to increased student achievement by increasing the time students spend on collaborative learning experiences (Duma and Silverstein 2014, 12-13)
- Students in an undergraduate integrative art/science program report that the increased use of collaborative learning allowed them to listen to and learn from one another as they created works that were both scientifically accurate and aesthetically pleasing (Ghanbari 2104, 94)

Promote complexity in learning experience

- Studies on learning in and through the arts suggest "…a dynamic model in which learning in one domain supports and stimulates learning in others, which in turn supports and stimulates learning in a complex web of influence…" (Fiske 1999, viii)
- Synthesizing Elliot Eisner's and David Perkins's research into arts-integrated education, one study author states, "Beyond creativity and imagination, other kinds of meta-cognitive thinking have been implicated in the arts, involving the ability to: integrate divergent points of view, layer relationships, and construct unified

wholes—in other words, construct coherence among relationships within complex forms—as in paintings, musical compositions, choreography, or poems" (Burton, Horowitz, and Abeles 2000, 229).

Provide opportunity for synthesis and personal meaning-making

- Art educator Terry Barrett explains some of the value of student interpretation of art: "By carefully telling or writing what we see and feel and think and do when looking at a work of art, we build an understanding by articulating in language what might otherwise remain only incipient, muddled, fragmented, and disconnected to our lives…To interpret is to make meaningful connections between what we see and experience in a work of art to what else we have seen and experienced" (Barrett 2000, 7).
- Educational philosopher Maxine Greene considers subjective response to art and personal meaning-making: "We must confront the mystery of one subjectivity's grasping another, especially when the other has found expression through shared content, embodied form. We must try to comprehend how each of us, unique persons with unique life histories, can move inside works created by quite different human beings and actually discover ourselves there" (Greene and Lincoln Center Institute 2001, 21-22).

Research

Working in interdisciplinary settings can influence a faculty member's research. In particular, some colleagues from different disciplines who teach together extend that classroom relationship and become research partners as well. Similarly, exposure to ideas that collaborators bring from other disciplines can shape an individual faculty member's own research agenda. Experiences in the arts-integrative or interdisciplinary classroom impact a faculty member's research when students provide new ideas for research, or when the classroom serves as a place to refresh a faculty member's perspective. These impacts may go beyond an individual faculty member to affect the nature of research in a given field, sometimes introducing new research methodologies

Co-teachers develop research partnerships

- "I have developed a partnership with [my co-teacher] and we're writing a grant right now, to support the creation and the study of a rehearsal protocol and assessment tools for teaching medical students how to disclose distressing information to patients." (Q26-4019-6877)
- "We've taught it [an interdisciplinary, co-taught course] and each time we said, 'We need to do work together,' but you get too focused on the class. Now that it's done, we've started doing what we've always talked about." (Q26-2919-1692)

Co-teachers affect each other's research/creativity

- A faculty member from Dance and one from Music co-teach a Performance Art class; the experience has a powerful impact on the creative work of each. (Q26-2003-4967)

- "In the team-taught courses, we've ended up having conversations not just about the syllabus but also about our [research] work, where again you have this interaction between research and teaching." (Q26-5007-3103)

The classroom as catalyst for research

- "I've come out with a lot of research ideas by being forced, as it were, to think aloud in the classrooms. So I...sometimes develop ideas for research precisely because new things have been generated thanks to the discourse in the class." (Q26-5007-3103)
- "A lot of times the ideas for the research come from the course. For example, The Health Kiosk has come out of the course; the power wheelchair seating coach came out of the course. Once we see and have something to demonstrate to people, they get an idea of how to apply it in ways that we hadn't anticipated, and [that] often also serves as a basis for proposals for funding." (Q26-2105-370)
- "Teaching this design fiction class, you start engaging with that as a research process." (Q26-2102-300)

Change the nature of research in a particular field

- "I've been able to take a lot of ideas from Health and move them over to Environment. And I think with natural resource professionals, they've been able to take these different ideas that largely came from Health, but also Marketing, and then worked finally into the things that they do." (Q26-3918-7502)
- "I talked to them for over an hour before they realized that when I said 'a test,' there was going to be a human in the loop, as opposed to a CAM data file...Engineering is realizing more and more that they have a human as part of the system. It's not just the technology part." (Q26-2015-371)

New research methodologies

- Tools of arts-based research have transformed inquiries in sociology, psychology, health sciences, natural sciences, and business (Leavy 2017, 493-574).
- An Australian site-specific study involving arts practitioners, scientists, other scholars, and local people, "…finds that collaborative, embodied research methodology reveals and challenges our practices, invites new modes of investigation, and presents new questions and insights into place and practice." (Gibbs 2014, 207)

The University

Most of the interviews indicate positive impacts of arts integration and interdisciplinarity on the institution itself, but in this data set, some examples of negative impacts do arise--a reminder that "failures" surely exist in every area of impact although interviewees may be disinclined to talk about them.

Individual universities are impacted when arts-integrative and interdisciplinary initiatives strengthen connections between them and their surrounding communities. The shape of curriculum changes,

and university courses change when they not only function as vehicles for instruction but also begin to provide structured opportunities for students to engage with other disciplines. The campus atmosphere is similarly altered when the university simply furnishes a space for that interdisciplinary engagement to happen informally. When the arts-integrative and interdisciplinary work done by individual faculty members and departments leads to positive attention from the university, this attention can prompt administrative support and even institutionalized change. However, this same attention can also result in side-effects that some perceive as negative, such as an increase in the amount of administrative oversight in a department. A negative impact is also possible when the introduction of arts-integrative or interdisciplinary initiatives causes dissonance among faculty members.

University connections to community are strengthened

- "One of the things that I believe is that the arts can serve as one of the strongest bridges into our community for the university." (Q25-1306-7145)

Curricular change

- "It's been so successful that the Chair wants to make this...part of the core in the undergraduate level. Which would be the only one in the United States that does that." (Q26-2102-300)

Courses become opportunities to engage with other disciplines

- "In terms of impact, I would just like to see the way we teach and the way we research be reinvented, quite frankly, for the 21st century, and to give students what they seem to really want. Which is that the students themselves want the ability to create. I've got English majors who don't want to just be creative writing majors. They want to be creating in a broad sense. And they also want to be working across disciplines." (Q25-2001-4942)
- "They're coming from a world of different assumptions and interests, and the idea of our [engineering] students working with musicians in that way was really eye-opening for them." (Q25-1012-1944)
- "One of my students took the course and he's a filmmaker and he was in a class surrounded by musicians, so they would be able to talk about the music in these incredibly analytical detailed ways. But he learned so much from their perspective on things and he in turn was talking about film in ways they had never really experienced, so it was really this incredible interchange of knowledge that could only happen in a classroom where you could have students from different backgrounds coming together." (Q25-1012-1944)
- "The biggest thing is that students are really interested in working with people from other disciplines, particularly because they know they're going to be doing that the moment they get out the door." (Q25-1121-5677)
- "We desperately need those students with the ideas to mix with the Business students for there to be any success at all...The pattern that's developed then over time is that because they've had an opportunity to test their ideas, to learn how to talk to people that have different perspectives, they're accelerating." (Q25-2901-1318)

- "We were frequently scrambling combinations of students to get them exposed to as many different perspectives as possible." (Q25-2917-1649)
- "I think another real value for the art students or the math students is to try and understand another discipline on its own terms...It's nice to see what a different discipline thinks is rigor." (Q25-2909-1499)
- "I was thinking about what it would be like, from a faculty position, to try to work in a teaching environment with another person from the other side of campus." (Q25-2119-654)

The university provides a space for engagement

- "Our sculpture department had set up a fabrication shop where there's a wood area, a metal area, and having those things happen there gave the students who were directly involved really something to look at and think about." (Q25-3605-8045)
- "They've started a new campus housing where a couple of floors are just open laboratories for students just to do whatever. So there'll be tables, sewing machines, computer labs, and the idea is just the intermixing of students next to each other...So just bring students together without saying, 'Okay, now you're going to collaborate.' Just being in those open laboratories, they will naturally start to form those connections." (Q25-4002-6530)

Individual Disciplines

Although it is seldom mentioned explicitly in the interview data, one of the impacts that we assume as a secondary effect of arts-integrative and interdisciplinary programs in the university is that they will ultimately change the shape of individual disciplines. That is, the programs produce advances in the field as well as students who become tomorrow's teacher/researchers, the sum total of which is a field or discipline—be it engineering or music or gaming or medicine—transfigured by the influence of arts integration and interdisciplinarity. This is the type of broad impact that might be felt on any discipline.

Specific impacts on individual disciplines also emerged from the interview data and from our literature review. These disciplines are, naturally, the ones that, at this historical moment of the 2010s, are embracing the arts: science, medicine, engineering, and business. The discipline of education is also impacted, reflexively, as universities experiment with arts integration. These disciplines that partner with the arts feel the recurring impacts of *New Perspective, Awareness, and Understanding* and *Working Together*, as well as impacts unique to each field. For example, medicine, engineering, and business cite the development of certain arts-based capacities like empathy and creativity as an important impact of arts integration.

Any discipline

- "After we started teaching the [integrated] class, much of the work that happens in our areas is influenced by the kind of environment that the course creates." (Q25-2002-4952)

- "I think any university such as this is playing in a national or international arena, not just a local arena, so evidence of impact has to do with the ability to change the fields...if you're not impacting the broader discipline, you're probably not playing the role that a university like this expects…" (Q25-1309-7200)

Education

The products of research can be teaching-related insights or technologies, impacting the field of education broadly. Education is also impacted when students leave an arts-integrative or interdisciplinary program as better teachers, enhancing the field of education wherever they end up working, and when arts-integrative and interdisciplinary initiatives that are intentionally education-focused yield beneficial outcomes. There is also a reflexive impact inasmuch as the more arts integration is practiced as a teaching mode, the more support and enthusiasm it attracts.

Research products for the classroom

- "We've developed another sort of technology that sits on the top on that circuit computer, and it can actually tell whether or not the student is actively engaged in the session." (Q26-3710-8422)
- A design lab's partnership with a biology faculty researcher results in a 3D modelling system: "The system becomes a template that other faculty can use." (Q25-3409-823)

Students become better teachers

- "The impact is, for the students' part, more receptiveness as they are teaching. More receptiveness to what is going on with *their* students, so that they can make better decisions. We are actually able to see that now in the students who have graduated from the program and are teaching in the school." (Q25-2617-3859)

Education-focused projects yield positive outcomes for the field

- "Basically, twelve teachers a year are going to come to [our university], do research as graduate students; these are K12 teachers with STEM classroom experience, coming to us to do research on manufacturing. They all walk away with a desktop scale 3-D printer, and they all will develop a curriculum for that technology. So although it's not related necessarily to the arts...what's going to come out of that is a whole bunch of impact on the teachers and their students for years to come." (Q25-3710-8420)

Increased support for arts-integrative teaching

In a meta-study of three longitudinal studies of arts-integrative teaching, "Teachers' experiences in learning about and implementing arts integration resulted in strong support of its value for student learning. Between 89% and 93% of the teachers surveyed each year reported that integrating the arts added value to their repertoire of instructional strategies." (Duma and Silverstein 2014, 12)

Science

Collaborations between scientists and artist are becoming increasingly common, sometimes resulting in an innovation that advances some scientific field, or simply leading to scientific insights. The process of an interdisciplinary collaboration itself can provide the opportunity for scientific study. Finally, the arts can afford science more and stronger connections to a broader public.

Creation of new technology

- An interdisciplinary initiative results in the creation of new technology, as happens in a program that brings together Business students with students from Science and Engineering: "There's a lot of ideas that we've worked out that we've been able to do with the faculty and through the university. Great technology, but [industry] probably wouldn't invest any more time and money in it because it doesn't have commercial potential." (Q25-4010-6700)

Scientific insight

- "[In a photography/biology collaboration], to get a sharp edge through the photographic type of process, he [the biologist] learned a lot more about how light might be hitting and affecting those chloroplasts. He learned from the technologies of the arts more about biology, which has now enabled him to go after other monies in biology." (Q25-4203-876)

Opportunity for scientific study

- "Most games that we create, we do some kind of evaluation of what the game could teach people and did it really do that job. That's one of the reasons I have two social psychologists on staff, is to really study in depth. We do control the studies with a randomized participants. We do some very strict measurement of how the games are working and what psychological principles are being affected and which learning principles are being affected." (Q25-3407-787)

Increased connection to public/community of impact

- "When artists and scientists get together, creative sparks can fly. Collaborative sci-art projects are increasingly popular and one obvious benefit is the greater visibility of the research through the artist's work." (Stevens and O'Connor 2017)
- James Thompson, Associate Vice President for Social Responsibility at The University of Manchester, explains an initiative that funds art-science collaborations: "The projects supported as part of this initiative seek to challenge the notion that there is an automatic divide between the arts and sciences by encouraging artists, arts researchers and scientists to collaborate and share insights with students and wider audiences. We hope they produce outcomes that stimulate people to think differently about their own disciplines…" ("Arts and Science Collaboration")
- In an article about chemist Julian Voss-Andreae's sculpture, writer Philip Ball explains its value: "I admit that I am not usually a fan of attempts to turn molecular shapes into art; all too often this draws on the chemist's rather particular concept of

beauty, and a pretty picture does not equate with a piece of art. But Voss-Andreae's work is different, because it seeks to convey some of the underlying scientific principles of the subject matter, even to viewers who know nothing about them. That's what good 'sciart' does: rather than seeking to educate, it presents some of the textures of science in a way that nudges the mind and enlivens the senses." (Ball 2008)

Medicine

Although there is an ample literature on the therapeutic uses of the arts for wellness and in health-care settings, they do not fall within the scope of this paper, with its focus on the impacts of arts integration within the university. In that context, arts integration impacts the field of medicine primarily through the training of medical professionals. For medical students—as well as faculty and staff—the arts reduce stress and burnout. It also improves the observation skills upon which doctors depend for diagnosis (see the discussion, below, on transfer of skills for a detailed look at art used to train observation skills). Of the many skills and capacities that interaction with the arts imparts, empathy and tolerance for ambiguity emerge as important ones for the field of medicine.

Reduce stress and burnout for medical professionals

- A piano concert series and jazz reception program was organized at the College of Dentistry at New York University, in 2007. Faculty, staff, and students overwhelmingly recommended that music concerts in the dental college be continued, especially because of their beneficial impacts on stress, productivity, work-life balance, and the community. (Larsen et al. 2012)
- In response to high levels of anxiety among students, a study at the University of Michigan School of Dentistry provided several free, short chamber music concerts on-site during the day. Anxiety levels among dental students was substantially reduced post-concert, as measured by STAI-6 questionnaire. (Karl 2018)

Improved observation skills for diagnosis

- In one study, medical students participated in eight sessions that included art observation exercises, didactics that integrate fine arts concepts with physical diagnosis topics, and an elective life drawing session. Following the course, participants increased their total mean number of observations compared to controls and had increased sophistication in their descriptions of artistic and clinical imagery. A 'dose-response' was found for those who attended eight or more sessions, compared to participants who attended seven or fewer sessions, leading to the conclusion that the interdisciplinary course improved participants' capacity to make accurate observations of art and of physical findings. (Naghshineh et al. 2008)
- Nursing students participated in focused observational experiences to visually itemize everything noted in a work of visual art, discriminate visual qualities, recognize patterns, and cluster observations. They then organized these observations and drew conclusions about the art's meaning. Compared to students who did not participate in this initiative, they wrote more about what they saw, resulting in

significantly more objective clinical findings when viewing patient photographs. In addition, they demonstrated significantly more fluidity in their differential diagnosis by offering more alternative diagnoses. (Pellico et al. 2009)

Improved empathy and tolerance for ambiguity

- Clinician's Eye, a required course in the University of Virginia's medical curriculum, is an interactive workshop using visual art analysis to improve core clinical skills of observation, communication, collaboration, compassion, and reflection. Participants respond enthusiastically to Clinician's Eye, and demonstrate gains in their tolerance of ambiguity and uncertainty. (They also find that the museum setting, away from clinical practice and in the presence of well-made art, can refresh, renew, comfort, and inspire.)(Childress and Love)
- In one study, medical students and junior physicians engaged in a program of Visual Thinking Strategies, looking at art in a guided setting. The study concludes that "Art may contribute especially to the development of medical students' tolerance of ambiguity, also related to the enhancement of empathy." (Bentwich and Gilbey 2017)

Engineering

University engineering programs that incorporate the arts expose their students to different ways of thinking—a "recurring impact" in our taxonomy that bears special mention here—and may help them to be more creative.

New ways of thinking

- Northwestern University's McCormick School of Engineering brings art into the curriculum, maintains partnerships with Block Museum and the Art Institute of Chicago, and holds regular art/engineering events. The dean of the program describes, "In classes that combined engineering students with students from the School of the Art Institute of Chicago and from Northwestern's Department of Art Theory and Practice, groups developed new ways of visualizing social inequities in Chicago transit, games to facilitate interaction with autistic individuals, and ways to explore the commonality between sounds of laughter and sadness. The most rewarding outcome, however, was the collision of thought processes among team members." (Ottino)

Creativity

- A pilot study brought graduate art education students together with undergraduate engineering students to focus on an open-ended design problem related to sustainability and food within a local community. One student observed, "Many engineering undergrads are so tightly wound that this class may let them open up their minds; something they're not really 'allowed' to do in other courses. We are used to there being a right or wrong answer…when in art the only wrong answer is not being creative or imaginative." The study's authors note that while there are

> wrong answers in art, this student's quote demonstrates the value of making creativity and imagination an explicit objective." (Costantino et al. 2010, 53)
- The College of Engineering at the University of Iowa requires its undergraduates to take at least three semester hours in the creative arts, and has developed a program to support and promote collaboration between artists and engineers on campus. The purpose of this programming is to stimulate creative teamwork among students, faculty, staff, and visiting scholars. (Engineering and the Arts Collaboration)

Business

Experiences in the arts provide business students with opportunities to build important skills like creativity.

Arts-based skills

- At Sonoma State University's School of Business and Economics, some faculty integrate theatre and dance with business administration, with the intention of building leadership skills like critical thinking, creativity, and complex problem solving. ("Experiment in Arts Integration" 2016)
- University of Wisconsin business students who participated in a print-making project practiced skills "that are useful in both business and in life—collaboration, analysis, communication, leadership, creative thinking, and empathy, among others." (Richardson 2015)

Negative Impacts

Attention to a program carries negative side-effects, such as increased oversight

- "I would say that our disciplines were much freer before we started collaborating...They [administrators] didn't understand us and so they supported us kind of, you know [without question]. But now, more people feel like they understand us and so more people are interested in monitoring what we're doing and that's a price." (Q26-3706-8344)

Arts-integrative or interdisciplinary initiatives lead to discord among faculty

- "I was expecting wide support for the project, but I have found that I have received a surprising amount of resistance from certain members of the faculty." (Q25-3908-7686)

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Chapter 6: Impact on Students

The impact of the arts and interdisciplinarity on students is tremendous. Not only are there the direct impacts on their learning and socio-cultural experience discussed here, there are also lingering impacts on their futures, and indirect impacts by way of students' interactions with teaching, research, the university itself, and individual disciplines.

More than any other area of our analysis, this section on students represents a mix of impacts found in the SPARC data, in the literature, and in the U-M Arts Engagement study. These include impacts on learning, practical impacts that prepare students for standardized tests and the professional world they encounter beyond the classroom, and far-reaching impacts on students' non-academic experience. There are influences on not only their own growth and development but also their connections to others. Finally, student experiences with the arts impart a long list of skills and capacities. Included in this section is a discussion of two oft-cited capacities—creativity and tolerance for ambiguity—as well as an investigation into the possibility of *transfer*. That is, if experiences with the arts build creativity, is that creativity mobilized in non-arts contexts as well?

Student learning

The "Mozart effect," a theory that gained traction in the 1990s, suggested that musical training increased intelligence and could boost academic performance. Rigorous research in the ensuing decades demonstrates that although the arts do not increase IQ, they do support and enhance student learning in a range of ways. Much of this research has been carried out in the K-12 population, but there is growing interest in how these effects are present in higher education, especially since the 2018 National Academies of Sciences, Engineering, and Medicine report that integration of the arts and humanities with STEMM (science, technology, engineering, mathematics, and medicine) courses is associated with positive learning outcomes in higher education (National Academies 2018, 170). All of the impacts on student learning cited here, except "Provide practical experience," which is derived from the SPARC interviews, are drawn from the literature on arts-integrative education.

Increased risk-taking

Several large meta-studies on arts-integration cite increased risk-taking as a positive learning outcome (Deasy 2002; Duma and Silverstein 2014, 6; Fiske 1999). While these are K-12 studies, the mechanism that they describe is salient for higher education: in the arts-integrated classroom, students manage risk through permission to fail, and then take risks that intensify the quality of their interactions and products (Fiske 1999, xi). Students take the time to identify and seek out helpful resources, "as opposed to stopping at ready solutions and refusing to take risks of being wrong" (Deasy 2002, 28).

Show knowledge in multiple ways

While the concept of "learning style" is difficult to define and assess, there is general agreement that students bring a range of interests, talents, and proclivities to the classroom. Teaching with respect to this diversity facilitates student growth and development (Sorcinelli 1991, 21). This principle manifests in an arts-integrated classroom as the opportunity to demonstrate knowledge in multiple

ways (Duma and Silverstein 2014, 9), as students extend the presentation of their thinking beyond essays and slide presentations.

Improved attitude/increased motivation to learn

Several K-12 studies note that students are more engaged and interested in learning in an arts-integrated classroom (Duma and Silverstein 2014, 10; Ruppert 2006, 14). At the college level, a six-year qualitative study of an arts-integration initiative reports that students' creativity and self-confidence were bolstered, which in turn led to a changed attitude toward studies (Dahlman 2007, 276). This affective impact has implications for higher education, where burn-out and stress are common factors in student life. Undergraduates at the University of Michigan report that through their arts engagement, they feel less stressed, more refreshed, and better able to engage with new ideas and thinking (AE-UM: How did your involvement in the arts during college make you feel?)

Make connections among domains and ideas

Arts integration, as distinct from arts education, holds the promise of the arts interacting with and influencing other areas of inquiry. Indeed, one meta-study of K-12 arts integration reports, "Students engage in the creative process to explore mutually reinforcing connections between an art form and another curriculum area to meet evolving objectives in both" (Duma and Silverstein 2014, 6). Another K-12 study suggests that "…learning in the arts and in other subjects each contribute in their distinctive ways to a constellation of higher order cognitive capacities and dispositions—or ways of thinking—by activating them within broad and flexible pedagogical contexts" (Burton, Horowitz, and Abeles 2000, 253). These relationships have implications for the idea of transference (discussed below), especially for college students who, as they did in one study, demonstrate the ability to fluidly connect ideas across courses (Barber 2012, 608).

Improved long-term retention of content

Several studies indicate that arts integration improves students' long-term retention of content (Hardiman, Rinne, and Yarmolinskaya 2014, for example). This improvement can be at least partly attributed to the experiential aspects of the arts: "Retention of course concepts was also a benefit of the hands on approach to learning in the ArtScience program. In line with the experiential learning framework, participants noticed that the experience, or the 'making,' process helped the course content 'stick'" (Ghanbari 2014, 95)

Various positive cognitive effects

A host of studies demonstrate that learning in the arts positively impacts various aspects of cognition that affect learning. These include cognitive control (D'Esposito, 72), reasoning (Dunbar 2008, 82), generating novel and creative concepts (Dunbar 2008, 82), multiple or alternative vantage points (Burton, Horowitz, and Abeles 2000, 246), construction and organization of meaning (Burton, Horowitz, and Abeles 2000, 246), focused perception (Burton, Horowitz, and Abeles 2000, 246), critical thinking and problem-solving skills (Duma and Silverstein 2014, 9), increased access to procedural and schematic knowledge (Hardiman and Rich 2009), abstract thought (Ruppert 2006, 13), and more (for example, Catterall 2005; Moga et al 2000).

Provide practical experience

- "The MCAT, the entrance exam for medical school, is shifting in 2015 to accomplish much stronger emphasis for testing prospective medical students on social, cultural, and psychological content. They've come around to recognizing that health care practitioners really need to have some background in the social and behavioral sciences. For these students, they're first year students, and they get a heavy dose of me right away. I have that opportunity to influence their thinking for a full year. Are they going to do well on the MCAT because of that? I would hope." (Q25-2911-1531)
- Interdisciplinary programs connect students to internships: "A local blues musician called me...She was getting ready to go on an international tour, and she said, 'I need a student [from your program] to come in and help me with the marketing, with event planning,' kind of the business component of it, plus sound production as well. We sent it out to our students. We get them connected like that." (Q25-2406-4027)
- Students get hands-on experience in class: "They [our alums] begin to get promoted faster in the workplace and students have even, not students, some of the new employees have turned to our alums and said 'Why aren't you sweating through this exercise? Why aren't you terrified?' He [our alum] said 'Oh, I've done this so many times before,' or 'I've worked with these types of people and they're wonderful.' And so it's been exciting." (Q25-2901-1318)

Negative impact: conflict between arts and academics

In a study of one high school that adopted an arts-integrated curriculum, there were—in addition to positive impacts—instances of conflict between the arts and academics, when academic achievement was considered secondary to arts experiences and grades did not improve (Dorfman 2008, 55). A similar conflict is possible in the college classroom, if, for instance, the arts became students' main focus, usurping attention from non-arts content.

Student experience: Self and others

A white paper jointly released by the National Endowment for the Arts and the Department of Health and Human Services reports, "In study after study, arts participation and arts education have been associated with improved cognitive, social, and behavioral outcomes in individuals across the lifespan" ("Arts and Human Development" 2011, 7). Experiences with the arts have impact beyond the walls of the classroom, influencing students' development and social lives. Students and instructors alike recount how the arts promote personal growth, distinct from academic growth.

"Transformation" emerges as its own category of impact; in instances of transformation, students' fundamental attitudes, beliefs, behaviors, and goals change because of encounters with arts-integrative and interdisciplinary programs. For some students, the arts inspire a stronger sense of self, or impart meaning and purpose to life. Many students report simply that the arts are a positive experience, allowing for enjoyment and happiness. In addition to these inward-facing impacts, students create new social bonds and increase their social skills through the arts. Some are inspired to increase their civic engagement. The net result for some students is an increased sense of balance in their lives.

In this section on the student experience, we reiterate the intrinsic value of the arts. A report such as this one relies largely on an *instrumental* view of the arts; "integration" implies an attention to the arts-plus-something, not just to the arts themselves. Yet the arts assert their *intrinsic* value even in integrative settings; visual art, music, theatre, and dance are always potentially profound emotional, aesthetic, intellectual, spiritual, sensorial media. Although we use this section on student experience to remind the reader of that reality, it pervades all areas of impact. In fact, in much of our research—from the SPARC interviews to the University of Michigan study to the literature review— the impacts of arts integration are conflated with the impacts of the arts themselves. We choose not to disentangle this relationship; the arts do what they do, whether we find them in a theater, gallery, classroom, lab, or city street.

Students did report some negative effects—feelings of anxiety and exclusion—of their engagement with the arts. These feelings might also arise in an arts-integrated classroom or research setting.

Holistic growth and development

- "It was really more about this kind of growth, their [students'] own personal growth and their own understanding of what it means to be involved in a community and what it means to have the kind of experience that they've had in a program that just helped to think beyond the art itself." (Q25-3103-6159)
- "A number of them [students] that we spoke to said they have their eyes open to other possibilities for their music, and they went, 'I could do this.' This was really exciting for them and a unique experience." (Q25-2309-5957)
- One undergraduate's response to a question about how the arts have helped you grow: "Spiritually, emotionally, mentally, physically, tentatively, financially, qualitatively, quantitatively, happily, paradoxically, sexually, thoughtfully, and creatively." (UM-AE: In what ways do you think you can grow through the arts?)

Transformation

- "I really like to see, down the line, final outcomes, in terms of was that course instrumental in some way in that a student made a decision to follow an interdisciplinary path themselves? Did it end up in their research later on, or did it even preferably end up as a potential career?...We do find, sometimes, that if a course is innovative enough, that it will change somebody's mind about the direction that they were heading with their own career." (Q25-1203-6391)
- "We definitely saw that. I called it the forked path; that was one of the highest metrics for that course, was how many forked paths did we make. If someone was on the same trajectory in terms of where it would end up in employment, or where it would end up in grad school, and then after the experience of being in the course, they went somewhere else. To me, that shows that through reflection, or experience, or just exposure, we were actually having an experience which changed the way that [students] saw what it was they wanted to do in the future." (Q25-1804-6299)
- "[A student] said, 'Well, I didn't really want to be in this class but I thought it's something that I should do.' And he completely realigned his perspective from the start of the semester...and he came back for the second semester and he developed [a thesis on the topic] through the investigations across the discipline." (Q25-3701-8233)

Stronger sense of self, identity

- College students who major in a STEM field and have a dance minor indicate that they gauge their own self-efficacy as a sum of both their STEM and dance activities. They recognize the "duality of rigor" in STEM and dance and identify with both sides, despite implications of academic elitism and restrictive discipline identity from their peers (Payton, White, and Mullins 2017, 43).
- "[Because of engagement with the arts] I found my true self. I became a better friend." (UM-AE: What role did the arts play in your development as a person, friend, colleague, and student during college?)
- "You really find yourself through the arts. Traditional education will teach you and shape you, but through the arts you really get to find and define yourself." (UM-AE: Grow)

Purpose and meaning

In response to the question "How did your involvement in the arts during college make you feel?" undergraduate study participants replied:

- "It made me feel like I was growing in a whole new capacity that I didn't know was possible. Good, like I'm a part of something bigger than myself and bigger than this university." (UM-AE: How did your involvement in the arts during college make you feel?)
- "Like I'm part of something important." (UM-AE: Feel)
- "Like I had purpose." (UM-AE: Feel)

Positive experience

- "[The arts] especially made me feel expressive in a different way than my everyday life. It was a wonderful way to escape and have fun escaping." (UM-AE: Feel)
- "I really enjoyed participating in the arts and it made the college feel a little smaller and more intimate." (UM-AE: Feel)
- "I have loved my involvement in the arts at Michigan. It has made me feel valued. It has also been great socially and made me happy." (UM-AE: Feel)

Improved social bonds and social skills

- "It makes me feel connected with the rest of the student body. I may not be able to personally work in some of the events that I attend, but I am able to understand and appreciate the amount of work and dedication that was put in by those who I observe. I'm able to get an impression of the rest of my fellow students and of their work." (UM-AE: Feel)
- "Certain arts activities promote growth in positive social skills, including self-confidence, self-control, conflict resolution, collaboration, empathy and social tolerance." (Ruppert 2006, 14)

Increased civic engagement

- Data from the NEA's 2008 Survey of Public Participation in the Arts show that American adults who attend art museums or live art performances are far more likely than non-attendees to vote, volunteer, or take part in other community events. Arts participants also show a greater likelihood of involvement in sports, collaborative art-making, and taking their children to performances ("Art-Goers in Their Communities" 2009, 1-2).
- The University of Wisconsin School of Business, which regularly incorporates the arts into its curriculum, engaged its first-year students in a hands-on art-making project designed to support the semester's focus on social justice themes. "Our printmaking project was designed to create an opportunity for students to discuss and think deeply about mass incarceration, police brutality, and problems with the criminal justice system. By working together in small groups to design and create their own posters, they add their voices to the on-going dialogue around these issues" (Richardson, 5).
- Undergraduate's response to question about how the arts have helped you grow: "Become inspired to go out and change the world, change the nation and become a better person and American citizen." (UM-AE: Grow)

Finding balance in life

- "The arts have helped me continue a balanced lifestyle (by helping to relieve stress), and they have also helped me become a more 'cultured' person by viewing art from different cultures." (UM-AE: Role)
- "It [the arts] helped me explore my own beliefs and contemplate new knowledge and perspectives I gained from other people and their experiences. Art helped me become a more open-minded, thoughtful, and well-rounded person." (UM-AE: Role)
- "I think art provides a good balance to life. With the stress of my anticipated career choice, I will need time to do things for myself, for my own enjoyment. I think it will be just a wonderful way to reflect, to express, and to relax." (UM-AE: Grow)

Intrinsic impacts of the arts

- An extensive study of audience responses to music, theatre, and dance performances at nineteen on-campus venues finds that, to varying degrees, audience members experience captivation as well as intellectual stimulation, emotional resonance, spiritual value, aesthetic growth, social bonding, and satisfaction (Brown and Novak 2007, 11-17). We can expect students to experience some of those intrinsic impacts when they encounter the arts.

Negative impacts

The negative impacts reported here are drawn from student talk about arts engagement in general. They usually refer to participation in student-run organizations such as dance clubs, choirs, and jazz ensembles, or to the use of art studios and "maker" spaces. However, we can readily imagine these same feelings of apprehension and intimidation arising from participation in an arts-integrated classroom or research project.

Feelings of apprehension and anxiety

Undergraduates reported feeling anxiety at the prospect of participating in arts-related activities, because of a perceived inferiority in their skills or talents compared to their peers.

- "I felt that I did not have the experience and talent of others participating in the arts." (UM-AE: What do you see as the barriers preventing you from being involved in the arts at the University of Michigan (if you experienced any)?)
- "[There are] many other talented artists, which discourages people who aren't as naturally talented from participating because they aren't naturally 'artsy'…" (UM-AE: Barriers)

Feelings of exclusion and intimidation

- "I feel like the people that are involved are super passionate about the arts and sometimes I feel awkward going into their territory." (UM-AE: Barriers)
- "I know a lot of people who want to join choirs/dance clubs/art clubs but feel intimidated that they are too 'novice' for them." (UM-AE: Barriers)

<u>Student Futures</u>

The effect that a course or program has on students' future, particularly on their employment after graduation, is mentioned frequently in the interviews, perhaps because it is such a tangible impact. Interviewees boast that their graduates get good-paying jobs working as artists, designers, entrepreneurs, academics, and in many other fields, and take on leadership roles. However, this category includes more than just jobs (which are a significant benchmark of impact as well, addressed in Section II); it also encompasses continued higher education as well as attitudes that students carry with them beyond the classroom. Students who continue working in an arts-integrative or interdisciplinary vein or who cross disciplinary boundaries merit special mention.

Jobs after graduation

- "So we've had a number of students form artistic companies together that ten years later are still in New York City, actively producing seasons of new work." (Q25-2002-4952)
- Art students find success in non-traditional fields such as museum display fabrication and parade floats. (Q25-3614-8212)
- "I would point to the graduates of the program who have gone off to do some pretty substantial work...at Facebook and IDO and all sorts of places." (Q25-3614-8212)
- "One of our graduates now runs one of the finest eco-friendly building material supply houses in the country, and he has a huge clientele." (Q25-3614-8212)

Graduate school

- "It was not obvious that any of them [students in the class] was going to do that in the beginning, but a couple of them took a master's and a couple are going for their PhD." (Q25-2909-1495)
- "From our last class, someone got in the forensics graduate program at [a prestigious university], for photography. She said it was these kinds of classes that made her think about other applications." (Q25-2919-1691)

Altered attitudes and priorities

- Students think more intentionally about their possible role in the community after graduation: "I think a lot of them come in thinking, 'Well, I'm going to be the high school band director,' and that's great, but what about the nursing home around the corner or the center downtown for the children with special needs, or what are some other things in the community?" (Q25-2914-1579)

Professional success that hinges on arts-integrative or interdisciplinary experience

- Art majors go on to medicine, business, law, and finance: "Many students come back to me and they told me, well, we got to the [med school] interview. The interview was not at all about biology or this stuff, it was all about Leonardo da Vinci and his anatomical drawings. Things that they had worked with me. There is that part in which visual and historical background actually puts them on an edge." (Q25-1302-7083)

- "We have dance majors who are actually running these kinds of companies that involve this engineering and marketing process." (Q25-2404-3984)
- An alumna works at the intersection of museum display, science, and photography: "She's so interdisciplinary that nobody from any of the disciplines she works in knows who she is!" (Q25-3614-8212)

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Arts-based Skills and Capacities

This is a catalog of those skills, capacities, and characteristics that an arts-integrative or interdisciplinary education imparts to students. The presumption that these skills are transferable to other endeavors is threaded throughout the list, and "transference of skills" appears as its own, separately reported impact at the end of the list. Any transfer of skills has far-reaching impact, affecting student engagement with other fields and careers. That is, students bring the skills and capacities gained through the arts to, for example, medicine, business, and engineering.

Since many arguments for arts integration hinge on the acquisition of arts-based skills and on the transfer of these skills to other domains, this section includes a discussion of two of the most often-mentioned arts-based capacities (creativity and tolerance for ambiguity), as well as an analysis of the evidence for transfer of arts-based skills.

Creativity

(see discussion on creativity at the end of this section)

- "The projects have been really successful in the kind of experimentation and exploration that has gone on, and the progress that I've seen from their initial ideas to the final implementation." (Q25-2111-479)
- "[Arts-integrative education] teaches a set of innovative thinking skills that are increasingly valued in a competitive workplace...arts-based skills put those people in really good standing for the kind of fresh thinking that they'll need to do." (Q25-2411-4113)
- "…I get so sick of doing quantitative things all the time (for my major) it feels good to use the other side of my brain, and be able to be creative without the fear of messing up or being wrong." (UM-AE: In what ways do you think you can grow through the arts?)

Personal expression

- "Personal expression. The arts force you to reflect on yourself, what you've done in your life, how you feel about it, and what that means to you. I have yet to find another activity that forces you to do all of this like being in the Arts." (UM-AE: Grow)
- "It can get me to think outside the box, and to express myself. It seems like art is all about expression so it is a way to get out some stress and anger." (UM-AE: Grow)
- *Expression* is not so much the "free and undisciplined venting of emotion," but rather about a unique way of making meaning. Performing and visual arts have their own systems for meaning-making, and the sense of a work of art cannot be reduced to a verbal translation. (Hetland et al. 2013, 66) The personal expression that students find through the arts involves the construction of new meaning-making systems.

Resilience

- "[It gives students] resilience, because so much of what we do fails, and most of the other academic activities encourage safe success...It's short of perfection, short of completion of what could be done in that genre, and that's a really important learning lesson. We have employers who also ask graduates as a routine question now, 'Talk to

me about a project of yours that failed, and what did you learn from it?' Some of our highest GPA students can't answer that question because they haven't risked failure." (Q25-2401-3928)

Patience

- "[The arts] helped me develop patience, creativity in my approaches to problems, ability to articulate ideas about aesthetic qualities, ability to be in conflict with a friend without it being destructive to our friendship, and a greater sense of my personal responsibility in group endeavors." (UM-AE: What role did the arts play in your development as a person, friend, colleague, and student during college?)
- "Being involved in the arts teaches time management, patience, and discipline. These can all further a person's growth through life. (UM-AE: Grow)

Persistence, sustained engagement

- In visual arts classes, students are taught to focus, to develop mental states conducive to working, and to self-regulate. They are pushed to stick with projects, and not to give up. They engage with their art: "Engagement is what makes someone *want* to persist. Personal engagement means that one gets pleasure out of the work itself rather than simply working at something for some future goal." (Hetland et al. 2013, 52)

Abstract thinking

- Students with a BA in Art History succeed at medicine, law, and finance, and "...that is not surprising to us at all, because there is that form of abstract thinking that they get trained in, which goes together with manipulation of data." (Q25-1302-7083)

Envisioning and imaging

- In the visual arts, students "…think in images as they come up with an idea, as they progressively re-conceptualize their work, and as they imagine the steps to get there." (Hetland et al. 2013, 60). Students likewise think in sound, movement, and language as they create works of music, dance, and theatre.
- One study finds that arts-based activities afford students ample opportunities to imagine new scenarios: "At the minute-to-minute level, this means that young people get lots of practice in developing future scenarios, explaining ideas, arguing for a particular tactic, and articulating strategies. They talk about 'what if?' 'what about?' 'could we try this?' 'let's try…' They throw out imaginative situations for others in the group to consider…" (Heath and Roach 1999, 25)

Critical thinking

- "Those students that were more involved with the arts self-reported better critical thinking, better problem-solving, better oral and written skills…" (Q25-1805-6324)
- "We are bombarded by visual images...If you have that arts training where you slow your thinking down, then you think about what is it that I am consuming, what is it that I am being bombarded with and how do I feel about it? How is it intending me to feel and do

I agree with it and do I want to push back? So I think that's something that the study of the arts has to offer to everyone." (Q25-3604-8027)

- One study used the California Critical Thinking Disposition Inventory (CCTDI) to assess critical thinking in arts and non-arts undergraduates (freshmen and juniors). Between discipline groups, there was no significant difference in overall CCTDI score, but arts students scored significantly higher on several of the subscales: truth-seeking, maturity, open-mindedness. "These results suggest that learning in the arts builds strengths in several critical thinking dispositions and offers evidence that the arts do indeed enhance the disposition to think critically." The study attributes this to the inquiry-based nature of the arts (Lampert 2006, 215).

Spatial reasoning

- Engineering students improve their spatial reasoning skills in an art class (Q25-2411-4113).
- Meta-analyses of published and unpublished studies examined the relationship between music and non-musical cognitive outcomes. Consistently, active musical instruction lasting even two years or less leads to dramatic improvements in spatial-temporal reasoning skills, as does listening to music (Hetland 2000a; Hetland 2000b).

Communication skills

- "It has to do with writing, which I do think is a form of creative expression. And I think that they learn, in my field in particular, but I'm sure in others too, how to be more audience-centered in the way that they write...And then I know of other students, who [succeed at] anything, from Divinity School to being a stockbroker, because it's all about being able to express your ideas and being persuasive." (Q25-5209-7948)
- "That is part of what we try to do here, through our program, is to think about stories and to try to get students to understand: How do you tell a story in a compelling way? And how do you use media to help you tell a story?" (Q25-4410-4278)
- "To give people the power to express themselves and to understand how others are expressing themselves increases communication." (Q25-2411-4113)
- "Visual arts, graphic design, and architecture have immensely strengthened my communication skills - both verbal and visual." (UM-AE Role)

Leadership skills

- "Then there were all the leadership aspects—organizational skills, public speaking, involvement—all the kinds of things that you would expect to be part of skill-building around leadership, which are no different in the arts." (Q25-1805-6321)
- Some college students experience the arts as a mechanism to develop personal skills; one cites specifically, "personal development, arts appreciation, leadership, personal knowledge," while another recounts growth "in leadership, in creativity, in expression, in communication." (UM-AE Grow)

Problem-solving

- "Students in sculpture are constantly having their noses rubbed in the laws of nature and the laws of gravity. And when they get out, they have a lot of problem-solving skills that they apply elsewhere." (Q25-3614-8212)
- "Social problems, community problems, health problems, conflicts, risks. Many of our students want to be part of a solution, and having the ability to think about some pretty significant macro-level ideas is an important tool...The arts can assist in imparting that tool." (Q25-2911-1531)
- A group of professional researchers, lawyers, scientists, engineers, and business professionals who minored in Dance in college consistently noted how their current workplace practices draw on STEM-based as well as dance-based approaches to problem-solving (Payton, White, and Mullins 2017, 44).
- Numerous studies on the educational and cognitive impacts of the arts and arts integration count improved problem-solving skills among the many benefits (for example, Dahlman 2007, 276; Duma and Silverstein 2014, 10; Ruppert 2006, 13).

Self-confidence

- Almost a third (30%) of college-age participants in a study that included a graphic design class in their science and social science curriculum mentioned "better self-confidence" as a benefit of the class (Dahlman 2007, 276).
- Participants in the U-M study frequently cited increased confidence as part of their development affected by arts engagement. (UM-AE: Role)

Stretch, explore, take risks

- "Artists always try new things and reach beyond what they have already done. They play, take risks, explore novel associations, and make mistakes, not deliberately, but routinely and inevitably…Artists Stretch and Explore by using the practice of conditional thinking: What if I try it this way, or this way, or that? They seek out the unusual, push beyond the limits of what is understood, and stride into the unknown as if they knew where they were going and what they were doing" (Hetland et al. 2013, 91).
- "From the student perspective, I think what we've seen is a lot more willingness to explore, or awareness of, boundaries and specializations as we perceive them, and students being more interested in pushing at those or maybe trying to transcend those to some extent." (Q25-2914-1579)

Empathy

- "It can expand your worldview and enable you to understand others' cultural perspectives. It breeds tolerance, acceptance, and understanding of differences. So, in that sense, it can act as a tool for social change." (UM-AE: Grow)
- "By participating in the arts one is able to see the world from viewpoints that you might not have thought of before. The arts just expand your worldview and help you connect better to those that see the world differently from you…" (UM-AE: Grow)

- Empathy is counted among the intrinsic benefits of the arts, that has private-to-public value: "The arts expand individuals' capacities for empathy by drawing them into the experiences of people vastly different from them and cultures vastly different from their own. These experiences give individuals new references that can make them more receptive to unfamiliar people, attitudes, and cultures." (McCarthy 2004, xvi).

Tolerance for ambiguity

(see discussion on tolerance for ambiguity at the end of this section)

- A physician in a university medical school notes that his trainees are all high achievers, used to having the right answer. He observes, however, that there are very few clear "right answers" in medical practice, and includes live performance experiences as part of medical training precisely because they require a tolerance for ambiguity. (Putting it into Practice)
- A design studio course—co-listed between graduate business and theatre, speech, and dance—was offered in response to a national conversation about students' lack of flexible thinking skills. One of the course's instructors explains: "It's about mastering the SATs and finding a formula that gets you to the right answer…so in essence we've taught them not to take any risks and to know exactly what's expected of them. And this serves students well until they get to the university, and they find out actually we don't know if there is a right answer to a lot of these things … let alone what the right answer is when you start talking about serious problems like global warming or sustainability, or a lot of the things we're facing as a society today." Students remarked that the design studio changed their perspective on what they could and couldn't do and encouraged them to take risks, a mindset that de-prioritizes the need to be right (Shearin 2013).

Reflection, contemplation

- "I feel being involved in the arts requires you to go within yourself to find what pleases you. It involved a level of introspection that most other subjects cannot lay claim to." (UM-AE: Grow)
- "Artists reflect metacognitively when they explicitly consider their works or what they are trying to do, why they used a particular technique or color or composition, what meanings they are trying to convey, and so on…Artists evaluate when they interpret and judge the aesthetic success of their own and others' works. Evaluation involves some kind of direct or implicit comparison of a work with other works or with envisioned criteria or goals, and it always involves considering quality." (Hetland et al. 2013, 81)

Organization and time management

- "It [the arts] helped me become more organized and develop professionally. It also helped me get a better view on the world and appreciate what I have." (UM-AE: Role)
- "The arts helped me grow as a person and a student. I developed much better time management skills as well as effective organization skills…" (UM-AE: Role)
- "Helped me organize myself, think analytically, and develop leadership skills." (UM-AE: Role)

- "The arts brought me closer to a diverse group of students as we worked toward a common goal. The intense hours of practice also helped me develop my time management skills" (UM-AE: Role)

Responsibility, discipline, work ethic

- "[The arts] can help build relationships and character. It can teach discipline and responsibility, etc." (UM-AE: Grow)
- Among the impacts of a program that engages high school students with the plays of William Shakespeare are "responsibility to take risks and support others in taking risks…responsibility to approach the work and their colleagues with a spirit of generosity…and responsibility to the work and the group" (Seidel 1999, 88).
- "…I also think participation in the arts requires a lot of hard work and stamina, so you grow in those ways as well." (UM-AE: Grow)

Respect

- "[The arts] taught me discipline, respect, and opened my mind…" (UM-AE: Role)
- "[Through the arts,] you can become more open-minded and respectful of others while gaining your own set of morals and beliefs through self-expression." (UM-AE: Grow)

Observation, attention to detail

- Artists use the habit of observing all the time "…But observing goes beyond looking and means moving beyond habitual ways of seeing. Students need to learn to notice things that might otherwise be invisible and therefore unavailable as content for thinking." (Hetland et al. 2013, 73)
- Medical students in an arts-based workshop engage in small-group exercises in (among other areas) mindful attention, description and interpretation (and noting the difference), and communication. These activities enhance learners' visual literacy, pattern recognition, which in turn hones their clinical competencies, including diagnostic acumen. (Childress and Love)

Technical art skills

- "Students develop the disposition to use skill attentively in various media and tools, and with conventions…Students develop a sense of what they can and cannot do with different tools and materials, and they become more adept at choosing the right tools and materials for the piece they wish to make. As students develop technique, they also learn about the elements of artworks, such as form, line, surface, value, and how to employ artistic conventions such as perspective or color mixing." (Hetland et al. 2013, 41)
- "…it helped me with time management skills because dance practices take a large chunk of time, but it also developed me artistically and gave me another chance to develop my dance skills." (UM-AE: Role)
- "I have begun arranging music, developed an interest in photography, and took a print-making class – none of which I did before college." (UM-AE: Role)

Transference of skills

(see discussion on transference of skills at the end of this section)

- "What we're going to teach them here is skills that they can transfer to anything or keep in music, either way." (Q25-3106-6257)
- "I see a lot of students in that situation where they're using skills that they've cultivated within the art context and then kind of transferring them to the other context." (Q25-3613-8194)

Discussion: Creativity, Tolerance for Ambiguity, and Transference of Skills

In general, this ontology does not claim to establish either causality or explanation for the impacts cited; it is simply a record of impacts reported in the SPARC interviews, the U-M Arts Engine surveys, and, to some extent, the literature. However, because the reported cognitive impacts of the arts on students are of particular interest to users of the ontology, we attempt to unpack them a bit here. Are these impacts important, useful, and beneficial? And are they active only in the world of the arts, or do they transfer to other domains?[*]

Here, we examine closely two attributes that are often credited to the study and practice of the arts: *creativity*, and *tolerance for ambiguity*. For each, we summarize the evidence for the arts' impact on it, as well as why it is important or valuable in worlds outside the arts. That is, if students gain a greater tolerance for ambiguity through their experiences with the arts, is that a good thing? Does that tolerance matter in non-arts contexts? Then, we consider the matter of *transfer*; is tolerance for ambiguity heightened only within arts experiences, or elsewhere in a student's life as well? We expect that this discussion will add depth to the broad range of impacts described in this project, enabling more purposeful arts integration and better-informed advocacy.

Creativity

Creativity Defined

A complete account of creativity—including its sources, markers, and neurology—is beyond the scope of this paper. We aim here to establish a common baseline understanding to inform discussion of creativity as an impact of arts integration.

We start with a fairly simple definition of creativity. The NEA's summary of creative thinking comprises memory, divergent thinking (the ability to generate possible solutions), and convergent thinking (the ability to think strategically, to apply logic and discretion to narrow a quantity of ideas to the best ones) (National Endowment for the Arts 20). As researchers continue to model creativity, some also acknowledge intelligence and personality as control variables that modify convergent and divergent thinking (Agnoli, Corazza, and Runco 2016, 172). These parameters are consistent with a commonsense notion of a creative person—someone smart, who comes up with ideas that are not only novel but also "good"—and we can use them as a sketch, to be fleshed out with additional explanations of creativity.

We can enhance—and substantially complicate—our picture by turning to the research that seeks to provide evidence for it. This research tends to use two approaches in its experiments: measuring various capacities and characteristics that inform creativity (with behavioral testing), and looking at creativity as a neurological, brain-based phenomenon (through neurological testing, usually fMRI). An examination of both the capacities and the neurological activity associated with creativity informs our understanding of it.

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[*] Further research is required to ascertain whether cognitive impacts associated with the arts are unique to the arts, or whether a student could obtain the same impacts through some other pursuit?

Creative capacities and characteristics

Behavioral tests that measure creativity often look for certain capacities that have been associated with it. The capacities upon which one of the most widely used creativity tests is based are enumerated here, as are capacities that other research identifies as salient.

The Torrance Tests of Creative Thinking (TTCT), developed and refined since their creation in 1966, measure the following capacities:

- Fluency, or the number of relevant ideas.
- Originality, or the number of statistically infrequent ideas. Originality shows an ability to produce uncommon or unique responses.
- Elaboration, or the number of added ideas. Elaboration demonstrates the subject's ability to develop and elaborate on ideas.
- Abstractness of Titles (for pictures). Based on the idea that creativity requires an abstraction of thought, this measures the degree a title moves beyond concrete labeling of pictures.
- Resistance to Premature Closure, or the degree of psychological openness. This measure is based on the belief that creative behavior requires a person to consider a variety of information when processing information and to keep an "open mind" (Kim, Kyung Hee 2006, 5).

Other aspects of cognition also play a role in creativity. Torrance factors in thirteen creative strengths: emotional expressiveness, storytelling articulateness, movement or action, expressiveness of titles, synthesis of incomplete figures, synthesis of lines or circles, unusual visualization, internal visualization, extending or breaking boundaries, humor, richness of imagery, colorfulness of imagery, and fantasy (Kim, Kyung Hee 2006, 5). The Root-Bernsteins' "13 Thinking Tools of the World's Most Creative People" likewise identifies a list of cognitive "tools" that support creativity: observing, imaging, abstracting, recognizing patterns, forming patterns, analogizing, body thinking, empathizing, dimensional thinking, modeling, playing, transforming, and synthesizing (Root-Bernstein and Root-Bernstein 2013). Additional studies of highly creative adults have shown that they share these traits: flexibility, fluency, elaboration, tolerance of ambiguity, originality, breadth of interest, sensitivity, curiosity, independence, reflection, action, concentration and persistence, commitment, expression of total personality, and sense of humor" (Guilford 1973, 2-3).

While these capacities and characteristics, taken together, are somewhat dizzying, they are similar enough to allow for generalization; we see recurring themes in these lists. There is agreement that some combination of capacities and characteristics like these are associated with creativity, and indeed the experimental studies in the "Evidence" section, below, rely on a variety of tests (such as the TTCT) that measure the types of traits enumerated here. It should be noted that the way in which creativity tests go about determining their measurements is itself a matter for discussion (see, for example, Kim, Kyung Hee 2006; Plucker and Makel 2010; and Sternberg 2018).

Creativity in the brain

We can add dimension to our understanding of creativity by considering not only the capacities and characteristics that researchers associate with it, but also the physical phenomena in the brain that neurologists have associated with creative activity. Much of the neurological research on creativity uses fMRI testing, which measures blood oxygenation levels to particular areas of the brain. Interpreting fMRI data relies on the idea that brain activity is highly localized, with particular regions of the brain associated with particular functions.

As just one example of how creativity can manifest in neurological terms, the NEA report *How Creativity Works in the Brain* relates a neurological understanding of "flow"—that feeling of being fully immersed, energized, and focused, of being "in the zone," that some creativity researchers recognize as a key component of creativity (Csikszentmihaly 1996, 110-123):

> "Flow appears to be characterized by a shutting down of some normal brain functions and the super-charged activation of others. Using functional magnetic resonance imaging (fMRI) technology, Dr. Charles Limb has examined flow states achieved by musicians performing in laboratory control conditions. He reports that when the brain goes into altered states of consciousness such as meditation, dreaming, improvisation, and trancelike states, a phenomenon called hypofrontality in the pre-frontal cortex occurs; the usual activity in the pre-frontal cortex shuts down" (National Endowment for the Arts 2015, 21).

Indeed, Limb's fMRI images of a pianist playing jazz improvisation show medial pre-frontal area (self-expression) activated and lateral prefrontal area (self-monitoring) deactivated. Limb hypothesizes that in order to be creative, we must shut down some of the editing, inhibiting parts of ourselves so that they don't in turn shut down creative impulses (Limb and Braun 2008, e1679). Similarly, some accounts of the creative process include a back burner phase when we withdraw from the problem (Guilford 1973, 1), or "incubate" (Csikszentmihalyi 1996, 79-80).

Studies such as these—and those cited in the "Evidence" section, below—advance our understanding of how creativity works in the brain; however, researchers caution that fMRI results should not confuse location with mechanism, recalling phrenology. Creativity is likely a distributed network, spread throughout different areas of the brain – "a sort of 'brain vaudeville' with screens happening at many locations at the same time" (Erlich 2016, 13). As Limb himself notes in a videotaped presentation, "These are not the 'jazz' areas of the brain" (Limb 2011).

Creativity in context

Finally, any attempt to define creativity must situate the individual within a context; we don't deem someone creative in a vacuum, but rather relative to a domain and a culture (Baer 2017; Csikszentmihalyi 1996, 28; Runco and Beghetto 2018, 4). One definition of creativity that attempts to marry all these factors states, "Creativity is the interaction among *aptitude, process, and environment* by which an individual or group produces a *perceptible product* that is both *novel and useful* as defined within a *social context*" (Plucker, Beghetto, and Dow 2004, 90). When we list "creativity" among the student skills and capacities that arts integration impacts, we are referring to the aspects of creativity that lie with an individual; however, following a more global, systems-oriented definition, culture, the community, and individual disciplines also affect our perception of creativity inasmuch as these areas constitute the context in which creativity is assessed.

Whether we employ the NEA's relatively simple recipe for creativity—divergent thinking plus convergent thinking plus memory—or account for all the nuance and perspective that complicates that recipe, the implication for arts integration in the university remains the same: creativity is more than just the generation of novel ideas. If it is actually this multi-dimensional attribute we value and hope to cultivate in students, then we must acknowledge its complexity rather than considering the arts a "magic bullet" that imparts creativity in a single encounter.

The Value of Creativity

Creativity—sometimes branded as "innovation," and usually referring to divergent thinking—is widely valued, in professional fields from medicine to business to engineering and beyond (Lichtenberg, Woock, and Wright 2008; "Engineering and the Arts Collaboration"; Shearin 2013; Styhre and Eriksson 2008; Broeck, Cools, and Maenhout 2008). Creativity is positioned as the quality that will distinguish job candidates from their competitors—including robotic ones—and will drive global economic success. Artists often represent paragons of creativity, when in fact they are examples of a particular type of creativity; there are creative people in every field and discipline.

Evidence of Arts Impact on Creativity

There is abundant literature theorizing and describing how the arts are *correlated* with creativity, but many interested educators seek evidence of *causality* as well as correlation. Can we stand behind a statement that arts experiences cause one to be more creative (even as we recognize that "teach" or "inspire" is a more apt verb than "cause")?

A meta-analysis of creativity studies on students from kindergarten to college-age, done in 2000, had difficulty finding examples of experimental studies (those that systematically compare the creativity of students with arts experience to those without, or students before an arts experience to the same students after). Based on those available studies, the meta-analysis claimed a correlation between the arts and creativity, but limited causality, allowing that conclusions were limited by the types of creativity tests used (Moga et al 2000, 92).

Now, nearly twenty years later, there continue to be case studies and theorizing that associate the arts with creativity—and we should not dismiss qualitative accounts in a positivistic quest for only a certain type of evidence—but there are also controlled experimental studies as well. What follows is a sampling of findings that show a causal relationship between study of the arts and creativity. Necessarily, each one situates its results within a particular artistic discipline and a specific dimension of creativity; nonetheless, they represent a mounting body of evidence that arts experiences increase creativity.

Examples of studies showing a causal relationship between the arts and creativity:

- Two studies, using the TTCT and other quantitative and qualitative measures, demonstrate that dance experience leads to increased creativity. More specifically, subjects scored higher on the fluency, originality, and abstractness of titles measures

on the TTCT (Kim, Juja 1998, 107; Minton 2003, 40). In one of these studies, "creative dance"—that which requires a measure of problem-solving—led to significant gains in creativity while traditional dance did not (Kim, Juja 1998, 107).

- Recall that one component of creativity is "divergent thinking," which involves thinking in multiple directions, seeking changes, and investigating. Some taxonomies identify individual elements of divergent thinking such as fluency (the quantity of unconventional and associated ideas generated on a topic) and flexibility (number of associations generated that relate to different fields). In one study, postgraduate students scored higher on both those aspects of divergent thinking after a ten-week creative drama course (Karakelle 2009, 127).

- Another study used behavioral, fMRI, and DNA testing to determine if there were differences between performing arts and non-performing arts students. Most notably, they found key neural differences between the two groups that, considered in light of the behavioral tests measuring divergent thinking, indicate that the performing arts students are better at the generation of novel ideas (Dunbar 2008, 90).

As a small sample, these studies offer a dual reminder—that the arts are not a monolith, and that creativity is multi-dimensional, involving personality characteristics of the individual, a loosely defined process, and a range of cognitive capacities. In this sample, we see a focus on the performing arts, and more specifically, on "creative" dance and drama that require students to generate ideas within a form. Likewise, we see results specifically in the area of divergent thinking, of coming up with those new ideas. While these are promising results, especially for those eager to see students "innovate," they only begin to address the expansive arena that is creativity. Other studies investigate relationships between other art forms and other aspects of creativity.

Tolerance for Ambiguity

Increased tolerance for ambiguity is one of the impacts attributed to arts integration, and in fact it is often linked with creativity and problem-solving (Brophy 1998; .O'Connor, Becker, and Bell 2017; Stoycheva 2003; Zenasni, Besançon, and Lubart 2008). However, there has been less sustained scholarly attention to ambiguity tolerance than to creativity, and hence, less evidence for the impact of the arts on it.

Nonetheless, we give it particular attention here because of the promise it seems to hold as an important capacity for those facing the complicated problems of the 21st century. Ambiguity tolerance may encourage divergent thinking because it is negatively correlated with dogmatism and the need for clarity, and positively correlated with ideation and innovation (Brophy 1998, 132). Furthermore, a tolerance for ambiguity is a natural fit with creative problem-solving because solutions often evolve through successive ideations (Ibid.), a process that requires the ability to persevere even while there is no "right answer" in sight. Finally, ambiguity tolerance is associated with Openness to Experience—a cognitive disposition that is in turn associated with a flexible cognitive style that is important for creativity in both science and the arts because it implies that new information or experiences have the potential to be incorporated into existing psychological schema

(Perrine and Brodersen 2005, 219). Similarly, we note the relationship between tolerance for ambiguity and the TTCT creative capacity Resistance to Premature Closure.

Tolerance for Ambiguity Defined

Ambiguous stimuli is that which is perceived as unfamiliar, unclear, having multiple incompatible interpretations, and most commonly, offering inadequate information to be clearly understood (McLain 1993, 184). Ambiguity tolerance refers to the way people perceive or process ambiguity when confronted with it. "The person with low tolerance of ambiguity experiences stress, reacts prematurely, and avoids ambiguous stimuli. At the other extreme of the scale, however, a person with high tolerance for ambiguity perceives ambiguous situations/stimuli as desirable, challenging, and interesting and neither denies nor distorts their complexity or incongruity" (Furnham and Ribchester 1995, 179). Ambiguous artworks provide that challenge and interest to viewers who go through a process of trying to make sense of them. Even if the "puzzle" isn't entirely resolved, many people find it rewarding to figure out parts of it and to know that even more lies within. Furthermore, the process can lead to insights for the viewer (Muth, Hesslinger, and Carbon 2015, 206).

Described cognitively, ambiguous situations are ones that present too little information to be clearly classified into a mental model that enables choice and action. In this case, where the brain can't identify the appropriate behavioral response, anxiety arises; the level of that anxiety indicates an individual's ambiguity tolerance. We are generally averse to ambiguity when there is the possibility of harm, but when the stakes don't include danger, there is a space for curiosity and attraction to occur (McLain, Kefallonitis, and Armani 2015). The stakes of interpreting an ambiguous artwork are usually low, while the stakes of diagnosing an ambiguous set of bodily symptoms may be high, but an individual with a higher tolerance for ambiguity will experience less anxiety in both situations than someone with low ambiguity tolerance.

An alternative description of the brain's response to ambiguity states, "True ambiguity results when no single solution is more likely than other solutions, leaving the brain with the only option left, of treating them all as equally likely and giving each a place on the conscious stage, one at a time, so that we are only conscious of one of the interpretations at any given time...Each interpretation therefore is as valid as the other interpretations, and there is no correct interpretation" (Zeki 2004, 175). In this view, the capacity to hold multiple interpretations is not a separate mental faculty specific to the arts; it is a general capacity of the brain that has an important role in the acquisition of knowledge (Ibid., 190).

Since the origin of the concept of ambiguity tolerance in 1948, it has diffused into many areas of psychology and been associated with a variety of psychological variables. A range of tests exist to measure an individual's tolerance for ambiguity (Furnham and Ribchester 1995; McLain 1993; Mostul 1977).

The Value of Tolerance for Ambiguity

Most disciplines in the humanities, and professions such as medicine and law, are rife with contradictions and lack of clarity—in short, ambiguity. People who are comfortable with uncertainty

and the lack of a single right answer can thrive in these situations, and can hold a space for unconventional answers as well as the views of others (Giguere 2014). As such, both the university and the professional world increasingly see value in cultivating individuals who find ambiguity interesting and desirable.

Typical of many faculty, one professor of business administration notes that students at his institution are less and less tolerant of ambiguity, and more concerned with finding the one right answer to a problem. This mindset presents a disconnect with the real world, which the professor characterizes as "increasingly complex and disruptive, and nobody knows what the right answer is" (Shearin 2013). Students seem to need a curriculum that acknowledges ambiguity as commonplace; indeed, "Tolerance for ambiguity resembles or seems related to a cluster of traits and abilities that are desirable in college-level learning" (Tatzel 1980, 377).

Evidence of Arts Impact on Tolerance for Ambiguity

There is some evidence establishing a causal link between arts integration and an increased tolerance for ambiguity. One study found that students entering college in the Arts scored significantly higher in tolerance for ambiguity than Business students, "a finding which supports the linkage of tolerance for ambiguity with creativity and mental flexibility" (Tatzel 1980, 378). In another study, medical students participated in a pedagogic approach called Visual Thinking Strategies (VTS) which asks students to discuss art works and decipher their different possible meanings. Based on student surveys, researchers conclude, "Art may contribute especially to the development of medical students' tolerance of ambiguity, also related to the enhancement of empathy" (Bentwich and Gilbey 2017, 1). (See below for a closer look at arts integration into medical training.)

These findings speak to a correlation between the arts and ambiguity tolerance, not a causal relationship—that is, perhaps students in the first study chose to major in the Arts because they were already tolerant of ambiguity. They also rely on students' self-reporting as primary evidence. However, like the National Academies of Sciences, Engineering, and Medicine (NASEM), we acknowledge how difficult it is to carry out causal studies on educational interventions and how few such studies there are. Although the current evidence base is limited, we find the links between the arts and tolerance for ambiguity promising enough to recommend the pursuit of arts integrative approaches, as does NASEM (National Academies 2018, 4).

<u>Transfer</u>

Assumed in much of the SPARC interview data on impacts of arts integration is the idea that skills gained through the arts will transfer to other domains, that a student who works creatively in an art class will also mobilize that creativity in engineering or business. Therefore, the issue of *transfer* is of considerable importance.[†]

[†] We pause to reiterate that while a discussion about transfer is instrumentalist in nature—considering how the arts might make students better at something else—it is never our intention

Much of the literature on arts education transfer examines specific instrumental claims—for example, that the arts will improve academic performance in non-arts areas like reading and math. Only a very few of these claims have been proven (Hetland and Winner 2004; Winner and Cooper 2000, 11). More salient for our purposes is the question of whether higher order thinking skills transfer; that is the type of "transfer" we explore here.

Framed more broadly, we are assuming that higher order thinking skills like creativity and domain-general problem-solving skills can be applied in specific domains. Indeed, there is evidence that cognitive skills such as problem-solving, inventive thinking, and decision-making operate across domains, and that, when faced with novel situations, people routinely try to apply knowledge, skills, and specific strategies from other, more familiar situations (Perkins and Salomon 1989, 22). One explanation for the mechanics of this transfer stipulates that the person faced with a novel situation must mine a familiar domain for principles, decontextualize them, and apply them in abstracted form (Ibid., 22). This is precisely the process we envision when we discuss engineering or business students mobilizing, in their chosen discipline, the habits of mind learned through the arts.

Some educators see the imparting of domain-general problem-solving skills as paramount in a rapidly shifting cultural landscape:

> In the technology-rich and fast-paced societies of the 21st century, we encounter problem situations on a daily basis. These problem situations need persistent, self-regulated, cognitively complex, and planned actions in order to be solved. Besides domain-specific problem solving skills, students need to be equipped with a set of diverse skills and exploration strategies that can be transferred to a number of situations and that are applicable across several domains (Greiff et al. 2014, 75).

One study of graduate students demonstrates just such a transference of domain-specific skills to new situations; students of law, psychology, and medicine applied reasoning strategies taught uniquely in their discipline to everyday problems (Lehman, Lempert, and Nisbett 1988). We expect that students can likewise apply the exploration skills and habits of mind associated with the arts to a range of situations.

Theorizing and Demonstrating "Transfer" from the Arts

James Catterall, influential scholar of arts and learning, theorized how arts-based learning might impact higher order thinking skills, suggesting that "…experiences in the arts create capabilities or motivations that show up in non-arts capabilities" (Catterall 2002, 152).

Catterall also defined "transfer" in terms of distributed cognition or situational cognition. That is, transfer is not so much a unidirectional projection from the arts to some other domain, as a complex system in which arts learning is entangled or entwined with other learning (Catterall 2002, 156-157). Similarly, we can think about "transfer" as a dialectical relationship between the arts and other domains of knowledge: "…learning in the arts and in other subjects each contribute in their

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to reduce the arts only to their instrumental value. The intrinsic value of the arts is assumed here, but we take this opportunity to articulate the additional value that the arts bring to an interdisciplinary endeavor.

distinctive ways to a constellation of higher order cognitive capacities and dispositions—or ways of thinking—by activating them within broad and flexible pedagogical contexts" (Burton, Horowitz, and Abeles 2000, 253-254).

Arts integration entails just such activation, and this sort of intellectual entanglement is evident in a six-year qualitative study of science and social science college students who took a graphic design class. Students' written responses indicate that artistic experience in class helped them develop problem-solving skills, and see the environment in new ways. The focus on drawing is deemed especially effective because it requires students to connect seemingly incompatible categories of experience (Dahlman 2007, 275), a habit of mind that serves in science and social science as well as in art. Another study identifies eight such habits of mind associated with "studio thinking"—including observing with acuity, reflecting (thinking meta-cognitively about decisions, making critical and evaluative judgments, and justifying them), persisting through frustration, and taking risks. These habits of mind are already taught and practiced in studio learning, and theoretically, could transfer to student learning across the curriculum (Hetland et al. 2013), although there are not yet studies establishing this. However, we do see that across several schools that have adopted an arts-integrated curriculum, "Teachers and school leaders believed that arts integration encouraged students to give more thoughtful and thought-provoking responses to questions rather than quick answers; assisted students in developing their critical thinking and problem solving skills; and helped students to better articulate and justify their opinions. Teachers also gave high ratings to the impact of arts integration instruction on students' ability to approach ideas from multiple perspectives" (Duma and Silverstein 2014, 10). While there are many other factors at work in these schools that more rigorous studies would control for, these reports indicate that indeed arts-related habits of mind seem to transfer beyond the walls of the studio.

The six-year study of science and social science students also concludes that drawing changed students' ability to concentrate as well as their attitude towards studies, resulting in an effect on overall learning (Dahlman 2007, 276). This conclusion speaks to a different sort of "transfer" that occurs when arts-integrated learning has affective results. There is abundant evidence of such affective development because of the arts; willingness to put skills to use, interest, engagement with tasks at hand, importance assigned to success, and feelings of self-worth are just a few of the areas in which arts experiences impact learning (Catterall 2002, 154).

Conditions for Transfer

There are some questions about the conditions under which habits of mind learned in one context are mobilized elsewhere. One such question addresses how similar the new learning context is to the familiar context. If the two contexts resemble each other, engaging the same cognitive structures, this is considered a case of "near transfer," while "far transfer" refers to skills used in situations that bear little similarity to the context in which they were learned (Catterall 2002, 154). Additionally, researchers agree that the conditions under which knowledge or skills are learned and later applied is important for successful transference (Brown, Kane, and Long 1989; Gick and Holyoak 1983; Perkins and Salomon 1989, 22; Tiruneh et al. 2018).

Most of the research into conditions for transfer of arts-related learning is with the K-12 population, where there is better evidence for near transfer than for far transfer (for example: Keinänen, Hetland, and Winner 2000). There are also questions about whether transfer needs to be explicitly

invoked by the instructor or whether it can be self-motivated; in some K-12 studies, "…thinking skills do not generalize beyond the context in which they are learned unless teachers directly address transfer and encourage youngsters to use their skills and competencies in other domains" (Burton, Horowitz, and Abeles 2000, 230).

A study of nine- and ten-year-old students illustrates that while near transfer is within reach for children, it needs to be suggested by teachers. The students participated in a museum course on looking at art, after which they analyzed a science-related picture—a fossil record of intersecting footprints. In their analysis, they were better at evidential reasoning, used less circular reasoning, and were more aware of the subjectivity of their interpretations than a control group. These findings support claims of near transfer from the arts to science because in both contexts the students did the same activity (look at a picture). Furthermore, they were asked the very same questions about it—"What's going on in this picture?" and "What do you see that makes you say that?"—helping to make the connection between the arts activity and the science activity explicit (Tishman, MacGillivray, and Palmer 1999).

Just as with children, transfer for adults depends on how they acquire knowledge and how they try to mobilize it in new situations. Transfer occurs only under specific conditions, which often are not met in everyday life or lab experiments (Perkins and Salomon 1989, 22). However, if instruction is tailored, the potential for transference—even far transfer—increases. Instruction that incorporates meaningful tasks, teacher modeling through thinking-aloud, multiple opportunities for students to practice the desired thinking skills, teacher coaching and feedback, and student reflection all promote transference (Tiruneh et al 2018, 10). We can imagine arts-integrative classes readily incorporating these strategies. Especially important for far transfer, desired thinking skills should be explicitly taught during domain-specific instruction (Tiruneh et al 2018, 10). That is, in a class dedicated to the arts, whether it be in the studio or the classroom, instructors could articulate the thinking skills being used and note explicitly how they are applied.

However, some traditional college age students demonstrate the ability to integrate their learning independently, without tailored instruction. They connect similar ideas that themselves remain distinctive, apply knowledge from one context to another, and create new knowledge by combining insights. One researcher working with this age-group concludes, "…students' experiences on college and university campuses are much more related and fluid than our organizational charts might suggest. The stories from students indicate that it is in fact the students who are bridging boundaries to integrate learning, often unaided by a mentor or guide" (Barber 2012, 608). If this is so, then college students who acquire cognitive skills through the arts might make the transfer themselves, applying those skills in other contexts.

Example of Transfer in Medical Training

We can turn to the field of medical education to find a strong case for the intertwining of cognitive skills in college-age students. Several medical schools use arts experiences to bolster these skills in their students, with ample evidence that this is an effective approach.

There is some concern that young doctors are not being trained in the important skill of "inspection"—careful observation for the purposes of clinical diagnosis—but rather learning to rely on expensive high-tech testing. To address this need, several medical schools use a version of Visual Thinking Strategies (VTS), a pedagogic approach involving discussion of art works and their possible meaning. Typically, students participate in guided sessions looking at and analyzing works of art. For example, in one program, medical students spend three 90-minute sessions with museum educators and then respond to both art and patient images. After participating in this program, students significantly increased the amount of time spent looking at patient images, the number of words used to describe them, and the number of observations about the images (Klugman, Peel, Beckmann-Mendez 2011). Other medical schools that incorporate a VTS approach into their curriculum report that students make more accurate visual observations (Naghshineh et al. 2008, 995), have richer descriptions and propose more explanations for what they see (Pellico, Friedlaender, and Fennie 2009, 648), communicate more effectively (Slota et al. 2017, 1), and use more speculative thinking, marked by words like "suggest," "might," and "seems." These words imply the possibility of multiple interpretations of observations, and thus the likelihood of constructing a more in-depth explanation (Jasani and Saks 2013, e1329).

In addition to improvements in observation skills, VTS and arts-based strategies for medical students have also resulted in improvements in listening, explaining, empathizing, cross-cultural understanding, reflecting, and working collaboratively (Bentwich and Gilbey 2017; Childress and Love n.d.; Gottlieb et al. 2018; Lyon et al. 2018; Slota et al. 2017). The success of such arts-based pedagogies used in medical training rests on evident "transfer"—the ability of medical students to apply the habits of mind acquired in looking at art to patient scenarios.

Notably, many of the medical programs that incorporate the arts into their training specifically cite tolerance for ambiguity as a capacity that they want to build in their students, and that the arts is particularly effective at addressing ("About the Medical Arts" n.d.; Bentwich and Gilbey 2017; Childress and Love n.d.; Klugman, Peel, Beckmann-Mendez 2011; Weinstein 2011). One doctor has made attendance at live performance an integral part of training at his institution partly because of the tolerance for ambiguity that it promotes. He observes, "[Doctors are] constantly not sure what to do. And there's two ways you can deal with this ambiguity if you're a trainee. You can freak out; you can say, 'I want to know the right answer.' Or you can revel in it" ("Putting it into Practice" n.d.). He sees confrontation with the multiple possible interpretations of a music, theater, or dance performance as an excellent way to train tolerance for ambiguity in his students. (He also turns to visual art because of the way it traffics in ambiguity, empathy, complexity, and death—all important issues for young medical professionals) ("Art and Medicine" n.d.).

The medical schools that integrate visual arts and performance into their curriculum provide practical evidence for the value and utility of arts-inspired meta-cognitive skills, as well as their transfer to non-arts settings. That is, these medical schools incorporate the arts because they have found them to be effective; their students become better doctors because of their experiences in the arts. This does not allow us to make claims about all the arts, all the meta-cognitive skills, or all the professions. It does, however, establish a practical use-case, the basis of which indicates that arts integration in the university may also have powerful benefits for future engineers, CEO's, scientists, and lawyers.

Chapter 6 (Arts-based Skills and Capacities, Discussion) References

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Chapter 7: World Outside the University

University-initiated or –centered arts integrative programs make their impacts felt beyond campus boundaries. In some cases, the students involved with these programs become agents of change, bearing those impacts with them beyond the university. In other cases, arts-integrative teaching and research that are also publicly engaged directly impact areas such as the community, the economy, and the environment.

Community

Interviewees use "community" to refer to both geographic communities (the traditional definition of the word that implies a diverse population who live together in a given location) and to groups whose members share a characteristic or interest, such as "the Mexican-American community" or "the arts community." The arts-integrative and interdisciplinary work of students and faculty affects both types of community, through a variety of mechanisms; interviewees discussed active partnerships between the university and a community, university teaching and research that results in a product or service that benefits community members, the mere presence of a university arts or arts-integrative program that affects the local community (as when community members visit classrooms, or university artists exhibit their work publicly), and current students and alumni who take the expertise gained in the classroom into their work in communities beyond the campus.

In our effort to create a more expansive taxonomy—one that can accommodate more impacts than those that our study surfaced— we borrow from and adapt a typology developed for Princeton University's *Taking the Measure of Culture Conference* (Guetzkow 2002, 3). It defines categories of impact that the arts—broadly, not just those based at a university—have on a community,

Create something new that fulfills a need

- "We did a collaboration with Junior Blind where we basically went over there and the students, with the blind children, came up with this idea of a sensory garden for their facility there." (Q25-4701-2655)
- A university-based project results in a team of health ambassadors who go out into the community, using a variety of modalities to educate people about behaviors around and the science behind AIDS. (Q25-3104-6177)

Improve community image and status, identity and pride

- A student organizes an arts-and-culture-based downtown re-invigoration campaign. (Q25-2406-4027)
- Faculty and students work with residents to create unique, locally resonant playgrounds. "You've got a lot of members of the community who lend their expertise and every single school is different, every single place is a unique community, so you have to design for the soul of the community, if you will. What is it that makes that place unique and special?" (Q25-2706-2112)
- Engineers are trained to respect local culture and work with the expertise already there, mobilizing design as a force for positive change in communities. (Q25-2706-2112)

Build social capital

- "The speaker I have coming tomorrow, she is going to [visit] chemistry, environmental science, having dinner with environmental policy, government, landscape architecture people. Invited someone from the business school, and then she's meeting people from two local non-profits." (Q25-1319-7335)
- Alumni with an arts-integrative education are more likely to be engaged in cultural arts, affecting the fabric of the communities where they eventually settle. (Q25-2401-3928)

Economic development

- A university design team collaborates with Homeboy and Homegirl Industries to design and market t-shirts based on homeboy art and tattoos. Record sales of these t-shirts benefit the Homeboy Complex Center, which supports ex-gang members in their transition out of the gang culture. (Q25-4701-2655)

Increased presence of the arts

- "I always push students to exhibit their work at the end of the quarter and just re-engage with the real public." (Q25-4807-4747)
- "I'm not sure the arts in [our town] would be as strong as they are without our program, simply because a great many of their employees are really, in effect, volunteers that we supply--students doing internships and externships." (Q25-4201-841)

Negative impacts

- "I'm not sure the arts in [our town] would be as strong as they are without our program, simply because a great many of their employees are really, in effect, volunteers that we supply--students doing internships and externships. Then the paradox of that is that our graduates love [our town]. They want to stay, and there are no jobs because our students have all the jobs as volunteers." (Q25-4201-841)
- With NEA support, the town of Chapel Hill, North Carolina conducted a study of the economic impact of the arts on its downtown, identifying areas for further arts collaboration between UNC and downtown. While local businesses were largely enthusiastic about working with UNC arts initiatives, business owners did surface potential negative impacts of collaboration, including lack of adequate parking, low-quality artwork that would reflect poorly on businesses, lack of return on investment, and arts events that overshadow business. (Barber et al. 2015, 13)

Culture

"Culture" generally implies the sum of attitudes, customs, and beliefs that define a group of people; the scale of that group can range from the intimate (workplace culture) to the expansive (popular culture). Most interview references to impacts on culture seem to view "culture" broadly; the arts emerge as integral to culture in general. However, there are a few instances of research or creative endeavors that change, or have the potential to enhance, a specific culture. Additionally, the products of arts-integrative work can themselves be understood as cultural artifacts.

Arts as integral to culture, broadly defined

- "...I think that doing this work and putting people who are so good at their own artistic practice and their own research within their artistic discipline together to collaborate can only enhance culture and the community and bring really great events…" (Q25-2409-4088)
- "It's very critically important that the arts get represented, and that people do understand. Even through exposure you get a cultural change." (Q25-2411-4113)
- "Well, the arts in general—arts in design are the key ingredients that help define culture, right. And so any type of activity that can emanate from the arts or partner with the arts and touch culture on all levels I think will benefit it." (Q25-3606-8081)

Affecting a particular culture

- A student's research in Qatar includes surveying the landscape to locate and identify artifacts. (Q25-3601-7965)
- A faculty-authored music video is credited with inspiring a number of (mainly lower-class White) women to go back to college. (Q25-5201-7803)

Create products that are themselves artifacts

- In *Gifts of the Muse*, McCarthy notes that works of art can convey meaning to communities, for example, "…art that commemorates events significant to a nation's history or a community's identity, art that provides a voice to communities the culture at large has largely ignored, and art that critiques the culture for the express purpose of changing people's views." (McCarthy 2004, xvi).

Economy

Economic impacts of university-based arts and interdisciplinary activities resonate at a local level and on a larger scale. The arts—present as university performances and exhibitions—can function as an economic catalyst. They contribute to the attractiveness of a region as a destination, increasing the number of visitors. These visitors not only spend money on tickets to arts events, they also patronize local restaurants, hotels, and stores. Faculty members' interdisciplinary research may also result in projects that contribute to economic development. Separately, interdisciplinary initiatives demonstrate a unique potential for economic impact in that they incubate faculty research that can become the basis for new, profitable businesses.

Economic development

- "As we've gone after city and county funding to support the arts, we've always had to make some kind of case that beyond contributing from a cultural standpoint, they contribute financially to the community, i.e., through taxes, creating a destination for people traveling in and then that tax money supports social service organizations." (Q25-1306-7145)

- "I, to get a tenure appointment, had to demonstrate impact. So some of my programs are things like...promoting local foods or economic development through tourism." (Q25-3918-7501)

Profitable business from research

- "The initial goal was could we get Business students to mix with the Science and Engineering students around something...That was very successful just getting them together. What came about, which was something we didn't really expect, is we actually were successful starting a lot of companies based on faculty research. So we've now started about 45 companies that have raised around a hundred million dollars and employed a couple of hundred people. So we've had great success in getting faculty ideas out into the market." (Q25-4010-6700)

Environment

We see impacts on the environment when university teams partner with industry. These impacts may be direct and intentional--the result of a deliberate focus on environmentally friendly products or initiatives--as when teams of students design specifically for a sustainable resource like bamboo. There also may be an indirect environmental impact, as when a university data-visualization team devises a product that illustrates fuel calculations. These fuel calculators become part of a decision-making matrix that leads to choices that ultimately affect the environment. Additionally, some individual faculty members' research is centered on environmental issues.

University/industry partnerships for environmentally friendly work

- "We've worked with Happy Toy also. They're the biggest wooden toy company in the world, and they're trying to move into more sustainable products like bamboos. So they bought up about five square miles of a bamboo forest in China. And we flew our students over to China, to kind of just become their R&D engine. We took this multidisciplinary team idea and each of those teams could come up with whatever they decided that they wanted to make with the bamboo. Pretty specifically, toys, although we're looking to expand that into architectural things, next time we go over. So it becomes a little more multidisciplinary." (Q25-4701-2655)
- "We've worked with a number of different companies who are startups or who have some data that they'd like to have visualized or an idea that they'd like to have conveyed...We're working right now with an industry group that's retrofitting large ships to run on liquid natural gas. We're creating a calculator that will help people understand the various options that they have, the differences between diesel, high diesel, high sulfur diesel that they currently use, low sulfur diesel...It's a project that has huge implications because these ships use about twenty thousand gallons of gasoline a day. We're talking about large environmental impact." (Q25-3409-823)

Environmentally-focused research

- "What I want to have in the end is this sustainable ink. Because I know printmaking is not the most sustainable process..." (Q25-3910-7627)

- "[My programs include] promoting natural shorelines among lakeshore property areas or preventing aquatic invasive species in the state...I mean some of my campaigns have certainly succeeded at the state-wide level. But also we've even been picked up at the national level; for example, one of my programs recently to engage bait shops to communicate with their customers is being rolled out in a seven-region area in the Mid-Atlantic and it's found success." (Q25-3918-7501)

Policy and Governance

Some arts-partnered projects seek to communicate information about important issues more effectively, with the expectation that increased awareness and understanding of these issues will affect policy decisions about them. Further exploration of arts-integrative and interdisciplinary teaching and research may uncover additional ways that this work directly or indirectly affects policy and government.

- A university-based digital modelling project seeks to influence policy by facilitating understanding of the metrics implicated in mass atrocities: "We're working on this atrocities project. They have large data sets that the Holocaust Museum and others have been collecting over the years that track a variety of metrics...The first order of business was to create an interactive visualization of that data, a map, but also other temporal information in some ways that people can understand the various metrics. If you understand that infant mortality rate is an indicator of an atrocity in some of the more poor countries in Africa and other places, then perhaps if you see a trend going up ... A humans' rights organization could come in and say, 'Oh, well, how much would we have to change that metric in order to reduce the risk of atrocity? ...Our goal is to help governments and policymakers and human rights groups write policy that's data driven and can help avoid the next atrocity." (Q25-3409-823)
- Artists collaborate with scientists to communicate the value of nature: "We are all faced with a changing world. My approach is to understand the science behind those changes, and to try to inform policy makers and decision makers about the science, so that we can make good policies and good decisions. I think a lot of has to do with how people respond to it, and value nature. Nature could be an ecosystem, it could be a species, could be process, it could be a feeling. I think, that artists play a really critical role in that, in helping make that bridge." (Q25-1307-7159)

Health and Well-being

Some arts-integrative partnerships and programs mobilize the arts' ability to affect our feelings of well-being. The arts can also serve the field of medicine as medium of communication, helping to disseminate health-related information.

Promote well-being

- A university partnership incorporates design into its research; their products subtly influence the way end-users feel: "We have quality of life, we have ways that we can

inspire ourselves through admiring art design and products that just make us feel good in some form or another." (Q25-3606-8081)

- A music-integrated program based in a university has measurable effects on client socialization and mood: "We have access to a lot of good measures that are well developed for what our [clients] are learning about socialization, or how is their mood changing as a result of this participation." (Q25-2914-1579)

- "[Participation in the arts] was a release and allowed for me to relieve my stress and tension from being in engineering classes only doing math and science problems all day…" (UM-AE: How did your involvement in the arts during college make you feel?)

Communicate medical information

- "We had one of our faculty in sculpture work with the medical school in visualization on every neck trauma so they were able to show what happens when you have some kind of accident that involves the neck." (Q25-3601-7965)

- "These game therapies, which include a lot of arts-related elements, are incorporated into behavioral aspects for patients, which then we integrate with medicines. So, what we hope to achieve is that the technologies right now that we are creating would be teaching patients health-related behaviors which will be watched by children. They will start learning the health-related behaviors which, then, they will translate to the next generation. And so the most far-reaching impact we can hope for is to create technologies in medicine which merge with drug-based therapies and impact patients' behaviors from generation through generation." (Q25-4021-6926)

- An on-campus Center dedicated to creative and cultural expression collaborates with a best-selling author on a novel. The story chronicles one woman's effort to lose 10% of her body weight and thus radically reduce her risk of diabetes: "The novel, I've measured that to some degree. We have had people who were in treatment in major medical centers with top doctors, who what they had been told before had not provided sufficient motivation and sustenance for them to continue, and they've come off insulin…So I measure that book in actual lives saved, helping inspire, particularly, Black women to get under two hundred pounds. So then changing some of the debate about Black women and fat to making it a focus on a community goal." (Q25-5201-7803)

- "Well, for that particular project, the original idea was to create this little team of health ambassadors that would be doing work at various places in the community that involved texting movement, and involved teaching people different ways to physicalize the concepts about their behavior and about, sort of, the science behind what was informing this very high AIDS rate." (Q25-3104-6177)

Chapter 7 References

Barber, Charlotte, Kalkidan Berhanu, Tammy Chen, and Paige Sferrazza. 2015. "UNC/Chapel Hill Arts Initiative:" Chapel Hill, North Carolina: Town of Chapel Hill. https://www.townofchapelhill.org/home/showdocument?id=27699.

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Section II: Assessing Claims of Impact

While the impacts data are a rich source of information and an exciting jumping-off point to further research, those data also beg the question *How do you know you have this impact?* That is, on what bases can interviewees make their claims of impact? We can assess their claims based on both explicit and implicit information in the interviews.

Chapter 8: Explicit Measurement: Benchmarks and Instruments

Here, the answer to the question *How do you know you have this impact?* is explicit: *We measured it*.

In Question 25, upon which our measurement-of-impacts research is based, the interviewer asked, "What impact did you hope to see? What impact did you actually see? How did you measure it?" He asked this all at once, so interviewees did not address each question separately. Actual and aspirational impacts are conflated, and in many cases, responses are somewhat stream-of-consciousness. Often the question of measurement is either not specifically connected to the impacts described, or not addressed at all.

The idea of measurement caused chagrin for some interviewees; they explained that they have no formalized means of doing it, that they are dissatisfied with how they do it, or that they are interested in acquiring methods to do it.

Interviewees talked about measurement in two ways; they gave accounts of *benchmarks* for measuring impact (*we know we are having an impact because we see "x" happening*) and of *instruments* for measurement (*we obtained our measures through "x" means*). There are more mentions of benchmarks (129) than of instruments (48) in response to a quite broad question about measurement. This seems to indicate that people are more ready to talk about what impact looks like than about assessing it.

Benchmarks

The most frequently cited benchmarks for impact (*we know we are having an impact because we see "x" happening*) are:

1. Involvement and enthusiasm—including student enthusiasm and numbers of participants.
2. Prestige and recognition—including awards, citations, publications, invitations, and more.
3. Continued effect—relevant activities, especially employment, and attitudes continue after participants graduate or exit a program.
4. Quality of the work produced—with "quality" understood as either "excellence," or as a particular quality such as "innovation."

Other key benchmarks include funding, user response, strengthened university/community connection, high test scores, and student transformation.

Interestingly, many benchmarks are also mentioned as categories of impact; for example, interviewees spoke of "prestige and recognition" sometimes as an impact of their work (*winning this award is one of the impacts of our work*) and sometimes as a measurement of their work's impact (*we know*

our work has impact because we won this award). This slippage between whether a given outcome is a measurement of impact or an impact itself could lie with the speaker—who may be most conscious of the positive nature of the award and not too concerned with a taxonomy for it—or with interpretation of the data. Since the questions of impact and measurement were bundled together, there is some uncertainty when unbundling the answers.

Instruments (explicit)

Interviewees cited the following as instruments of measurement (*we obtained our measures through "x" means*), in descending order of frequency:

surveys and questionnaires (including student evaluations)	62
informal qualitative data/feedback/anecdotal	32
work produced (its nature or quality)	11
formal interviews and focus groups	9
grading and rubrics	7
internal review	5
reflective documents	4
formal studies	3
national accreditation reviews	3
video	3
alumni tracking	1

Surveys and questionnaires are by far the most commonly used instrument for measuring the impact of arts-integration. We can assume that this instrument is most applicable to impacts on students, because it includes specially designed student surveys (22 mentions) as well as the standard student course evaluations administered by the university (23 mentions).

In addition, interviewees rely heavily on talking about the arts-integrative experience—informally as "feedback" and shared anecdotes, or formally as an interview or focus group—to measure the impact of arts integration. There are accounts of these types of instruments functioning for both student programming (including courses) and programming intended for the community and the public.

The quality or the nature of the work produced—including student projects, artistic collaborations, community programming, and research results—is notable within this study in that it is mentioned

in three categories: as an impact itself, a benchmark for impact, and an instrument for measuring impact. In this final category, a student's project, for example, becomes a yardstick; its goodness or innovativeness is the measure of the impact of that particular arts-integrative or interdisciplinary initiative.

Chapter 9: Implicit Measurement: Instruments and Types of Evidence

While the analysis above takes interviewee accounts at face value, here, we consider the information that is implicit in an interview response: the instruments that perhaps interviewees don't mention but which must have been used to obtain the results they report, and the types of evidence that inform their accounts. In this latter case, the interviewees may not directly address the question *How do you know you have the impact you claim to?* but the evidence they mention—or fail to mention—allows us to make inferences.

Instruments (implicit)

Based on the benchmarks for impact mentioned by interviewees, we can infer that there are other instruments of measurement that they did not cite explicitly. For example, the benchmark "involvement and enthusiasm" includes categories like course enrollment, waiting lists for courses, the number of students retained in the major or minor, and numbers in attendance at a program. All of these imply an instrument for measuring—something like a roster or a head count that tracks the number of participants—that interviewees do not cite. Likewise, another benchmark for success is "funding," which implies an instrument of measurement—such as a budget or grant award—that is not cited. These instruments are usually quantitative. By comparing the list of benchmarks with the list of instruments, readers will divine several such instruments—implied but not articulated.

Types of evidence

Although interviewees did not securely connect each account of arts-integration impact to an instrument or benchmark of measurement, we can glean some additional understanding of their claims of impact by considering the *evidence of impact* they embed in their stories.

Some interviewees offered no evidence with their claims of impact while some offered a range of types of evidence, detailed below. The relationship between the type of evidence and the type of impact is a subject for further analysis. The most prominent feature of this data is the great frequency with which interviewees cite their personal experience as evidence of impact. We can infer, then, that most often the answer to the question *How do you know you have this impact?* is *Because I've witnessed it myself.*

No evidence

Some accounts of impact are aspirational (recall that the interviewer's prompt included "What impact did you hope to see?"), or make no attempt to offer evidence.

- Impact on the university: "One of the things that I believe is that the arts can serve as one of the strongest bridges into our community for the university." (Q25-1306-7145)
- Leads to thinking beyond disciplinary boundaries: "It's more of a long-term thing, in terms of getting people to think outside of their narrow discipline and getting them to think a bit more broadly." (Q25-4019-6875)

- Develops creativity: "Social problems, community problems, health problems, conflicts, risks. Many of our students want to be part of a solution, and having the ability to think about some pretty significant macro-level ideas is an important tool...The arts can assist in imparting that tool." (Q25-2911-1531)

Unspecified evidence

In a few accounts, the speaker seems to allude to some evidence, but doesn't articulate it or make it explicit.

- Impact on the environment: "What I want to have in the end is this sustainable ink. Because I know printmaking is not the most sustainable process..." (Q25-3910-7627)
- Develops critical thinking: "We are bombarded by visual images...If you have that arts training where you slow your thinking down, then you think about what is it that I am consuming, what is it that I am being bombarded with and how do I feel about it? How is it intending me to feel and do I agree with it and do I want to push back? So I think that's something that the study of the arts has to offer to everyone." (Q25-3604-8027)

Assumed impact

In some accounts, the speaker describes a specific action or event, either actual or planned, and the impact of the action or event is assumed (*we're going to do, or we did, this thing, and we assume that it results in impact*).

- Bring together diverse thinkers: "One of my goals with my interactive lab is to create a network of other labs and other clubs in other campuses. So I'm going to be starting a working group with a distance-based collaboration." (Q25-3002-4559)
- Develops communication skills: "That is part of what we try to do here, through our program, is to think about stories and to try to get students to understand: How do you tell a story in a compelling way? And how do you use media to help you tell a story?" (Q25-4410-4278)

Personal experience

This is the most frequent type of evidence included in interviewee accounts of impact. The speaker refers to some impact that he or she has witnessed or experienced directly.

- Impact on research: "I've come out with a lot of research ideas by being forced, as it were, to think aloud in the classrooms. So I...sometimes develop ideas for research precisely because new things have been generated thanks to the discourse in the class." (Q26-5007-3103)
- Impact on student growth and development: "A number of them that we spoke to said they have their eyes open to other possibilities for their music, and they went, 'I could do this.' This was really exciting for them and a unique experience." (Q25-2309-5957)
- Impact on students' futures: "We have dance majors who are actually running these kinds of companies that involve this engineering and marketing process." (Q25-2404-3984)

External verification

In only a few instances, the speaker refers to some impact that has been verified externally; there has been some other measure of impact besides his or her own encounter with it. This measure is usually quantitative, and it turns up in areas where statistics are available.

- Impact on the economy: "The initial goal was could we get Business students to mix with the Science and Engineering students around something...That was very successful just getting them together. What came about, which was something we didn't really expect, is we actually were successful starting a lot of companies based on faculty research. So we've now started about 45 companies that have raised around a hundred million dollars and employed a couple of hundred people. So we've had great success in getting faculty ideas out into the market." (Q25-4010-6700)
- Exposure to the arts: "In the five years that I've run the film festival...we've almost tripled our attendance during that time. I just think it has been great partnerships within the community so that you broaden your audience base." (Q25-1306-7145)
- Quality of the work produced: "One of the student teams wanted to do a video. We worked with the place for the Center for the Study of Political Graphics, and we just finished a video for one of their fundraisers. And it was really quite successful, and in fact this was the best fundraiser that they've ever had." (Q25-4701-2655)

Conclusion

The taxonomy outlined in this series details the many and varied impacts of arts integration in the university. The taxonomy is an instrument that can be used for advocacy and case-making, as a locator guide for those seeking to identify where impacts can occur, as a shared reference point and vocabulary for those pursuing arts-integrative initiatives in the university, and as a springboard for further research.

There are numerous possible directions such research could take, including:

- **How is the picture presented in this report incomplete?** What impacts are missing, and where are the gaps? What impacts of arts integration and interdisciplinarity need to be surfaced and addressed?
- **How else might the impacts data be structured?** We have assigned roles and relationships to individual pieces of data and built an organizational structure around them. What are alternative ways to tell the story of the data?
- **How can we develop an effective measurement of impact?** What tools, methodology, and evidence are appropriate for demonstrating impact? How might new information about the scope or type of impact, obtained through measurement, feed back into the work we do?
- **How can we mobilize existing knowledge to broaden our understanding of the impacts of arts integration?** What other research overlaps this investigation, allowing the appropriation of relevant findings? What useful perspectives can sociology, psychology, game theory, business, history, and countless other domains lend to this research?
- **How can we delve deeper into the impacts in this report?** How could we establish a causal relationship (not just a correlative one) between arts-integration and a single impact such as "develops problem-solving skills"? Could a small-scale longitudinal study go even further, providing not only evidence of causality but even an explanation of *how* that impact is effected? What other means exist for learning more about the impacts we have discovered?

Finally, the taxonomy will ultimately become a historical artifact, a detailed representation of a particular aspect of early 21st-century culture.

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