Cognitive Development & Art Education

relationship, suitability, and future implications

Zheng Yao

Cognitive Development & Art Education
Relationship, Suitability and Future Implications

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Zheng Yao
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Approved by

Advisor
Dr. Paul A. Sproll, Professor, Head
Department of Teaching + Learning in Art + Design

Reader
Dr. Shana Cinquemani, Assistant Professor
Department Teaching + Learning in Art + Design

Reader
Dr. Thomas Mckeeff
Cognitive Neuroscientist, Lecturer, RISD

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Dedication

I dedicate this thesis to what has made me during this journey: my parents supported my MA study at RISD, my professors ignited me, my friends accompanied me.

谨以此篇硕士论文献给在这段旅程中成就我的一切：我的父母承担了我在罗德岛设计学院攻读硕士的花销，教授们启发并鼓励了我，朋友们与我相伴同行。

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我可爱的的采访对象们——他们为我提供了美国 K12 艺术教育的第一线视角；

所有在罗德岛设计学院教过我的教授们——他们在各种方面激发我、鼓励我。

Abstract

In this thesis the author sought to discover linkages between Art, Philosophy, Aesthetics, and Cognitive Science through a review of scholarship surrounding the integration of cognitive theories, art, and education. There have been numerous studies that claim that art education in elementary and secondary schools improves students' academic performance, interpersonal skills and improves attitudes to life. Nations meanwhile constantly modify standards and frameworks for teaching and learning in the visual arts. However, despite these changes, the author wondered to what extent, if at all, new standards-based visual arts curriculum frameworks were responsive to concepts within cognitive theory. This qualitative study analyzes the National Visual Arts Standards through a cognitive lens in order to detect the level of their connection to developmental theory. The author's interviews with practicing K-12 art teachers reveal the extent to which their curriculum design and teaching and importantly their students benefit from close alignment to cognitive science. The thesis concludes with thoughts for educators and policymakers that emerged as a result of this investigation and which may be transferable to diverse educational locations and in particular the author's home - China. This thesis does not claim to be exhaustive in the depth of its investigation, but the author hopes it provides valuable insights into the benefits of greater integration of cognitive science into art education. Further, it is the author's hope that the thesis provides a platform for her own further study at the doctoral level.

摘要

此篇硕士论文通过回顾认知理论、艺术与教育在学术方面的整合，作者试图寻找艺术、哲学、美学与认知科学的内在联系。目前已经有众多研究表明，小学和中学的艺术教育能够改善学生的学业成绩、人际相处的技巧，以及对待生活的态度。与此同时，各个国家也在不断地调整视觉艺术教学的标准和框架。除此之外，作者想要探究以新艺术标准为基础的课程框架在何种程度上符合认知理论。本研究以发展心理学的视角分析了国家视觉艺术标准与发展阶段的联系。此外，作者与四位美国中小学美术教师的访谈揭示了他们的课程设计和教学的程度，重要的是他们的学生受益于与认知科学的紧密结合。本文的结论为教育工作者和政策制定者提供了调查的结果，这些想法可能适用于不同的教育地点，特别是作者的家乡——中国。本论文的研究并不是包罗一切的，但作者希望能对认知科学融入艺术教育的益处提供有价值的见解。

同时，希望本论文能为博士层次的进一步研究提供基础和可能的平台。

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Chapter 1 A Light from The Unknown

Statement of Research Issue

Cognition connects people with the external world through their worldview and behavior throughout their life. “Cognition” has its history in philosophy and art, while cognitive sciences are relatively young, emerging with the breakthrough of new technologies. Developmental theories updated by cognitive sciences have helped educators to comprehend when students are able to understand certain things, and to what extent they can practice. Education is the national machine that shapes values and nurtures the labor force, in order to accelerate new generations’ development. Education needs to constantly renew itself. This thesis aims to explore cognitive development theories that could be more intently integrated into educational practice, the developmental view inside the latest version of the US National Art Standards, and possible implications in the future.

Secondly, a literature review on several major cognitive theories in art and science was conducted. After reviewing influential theories on art and cognition in the last 30 years, it could be discovered that art and cognition are closely related. Art-making is a highly synthetic process that coordinates perception, understanding and operating skills. Engaging in such processes aids to improve students' cognitive capacities.

Thirdly, this research explored the way cognitive development theories are integrated into art education, especially the setting of national or state art standards. Most art teaching standards are designed according to grade level or age stages, and each grade has different developmental goals. A survey of

US National Core Visual Art Standards (2014) would discover the scientific roots for educational guidelines and its vision of all-around talent nourishment. Additionally, reviewing frontline educational practices also helps to find the exact factors facilitating human development.

Finally, there will be a general discussion of the lessons learned from cognitive sciences, art theories, National Art Standards, and piloting tests of art education. Hopefully, this examination could shed some light for policymakers and K-12 teachers. Also, this thesis endeavors to explore transferrable or basic rationales for art education in different cultural contexts. In the end, standing on this point of history, with experience of the past, there are some suggestions for art education in the future.

Background and Setting

Before moving into further discussion, this thesis hypothesizes that ill-founded education leads to less satisfactory results and education that violates the natural laws of development is incompatible. Thus, only education that aligns with cognitive development best facilitates students' ability and personality.

Imbalances are the norm of this world. In order to rise in world standing, developing countries accelerate education. To get ahead of peers, children in eastern Asia are forced to study in advance of their actual levels—it is undeniable that children who already had studied the knowledge perform better than those who had not. This kind of competition will

not end until the knowledge level passes families' academic or economic abilities, which also to some extent decides a student's achievement. This situation becomes a vicious cycle—everyone gets exhausted but does not gain more benefits. If a more appropriate form of education could be found, it will ease the mental, physical and financial burden for families.

Methodology

In developing this thesis, I utilized several research methods including autobiographical narrative, critical review and analysis of select scholarly literature as well as interviews. In conducting the literature review, the author used RISD Fleet Library, ERIC.ed.gov, and Jstor.org to seek relevant literature sorted by keywords including cognition, cognitive development, development stages, art education, and so on. The search results are limited to the last thirty years, except keystones of art education. The TLAD Department also generously bought me important books including *Multiple Intelligence* (Howard Gardner, 2008), *Art and Cognition* (Arthur Efland, 2004) and *The Arts and the Creation of Mind* (Esiner Elliot, 2002) to support my study. Zotero also aided to organize those materials in chronological order.

In an attempt to better understand the views of practicing educators the author scheduled interviews with four art teachers from K-12 schools. They are Benjamin (elementary school), Tisha (elementary school), Kari (middle school), and Tiffany middle-high school and senior high school). The

interviews were based on a question survey list consisting of two parts: curriculum approach and student development, each with 3–5 detailed questions.

In-person interviews with art teachers would absolutely give more contextual information. However, in pandemic situations, they had to be substituted by Zoom meetings. The author arranged Zoom meetings with Tisha and Tiffany. Each interview lasted about 30 minutes: the interviewees were asked the list of questions first, and then they shared their students' artworks with notes.

Benjamin and Kari responded by email. The four art teachers also provided their evaluating standards, curriculum and relevant materials kindly in email attachments.

By comparing the answers in grade sequence, some general regularities could be found. Combining the provided rubrics of art subject and teachers' feedback of students' artwork, a deeper comprehension of art practices is formed.

Scope & Limitations

This thesis aims to draw on a period of the author's one-year master's program. Within this limited time, the thesis aimed to focus on a topic that was both practical and could scaffold further education.

It is worth bringing "Art" from peripheral playful objects into the rigorous academic lens and carefully examining its social function. For a long time, mainly science and technology have promoted social development and led to the reformation of academic disciplines. This thesis focuses on the practical side of cognitive sciences, in order to find updated guidelines for art education.

As Professor Sproll, my thesis advisor, suggests, National Visual Art Standards (2014) are highly representative and were carefully designed by eminent American art educators. The State of Ohio is famous for its art education standards, which have been widely adopted in many states. Moreover, in Ohio's standards the separation of media arts from visual arts suggests a new trend, which embodies the new media arts category in Ohio State Art Standards Draft (2021), compared with the 2012 version. Ohio's revision of its standards began in the fall of 2020 and will be finished in late spring of 2021, so the author witnessed the update of Ohio State Art Standards but regrettably was not able to see the final version before the completion of this thesis.

Also, from a personal point of view this thesis is important because of its China-rooted perspective as the author grew up and has lived in China for 23 years. It is important to note here that as a result of the COVID-19 pandemic and its travel restrictions, the author was not able to deeply research American cultural and social contexts as they would have wished. It was however the author's wish that even as a "bystander" she could discover something new.

Structure & Content

Chapter One provided research questions in the beginning. The theme of this thesis is the relationship of cognitive development and art education. And then methodology and structure for this thesis were briefly introduced.

Chapter Two traces the author's life experiences in order to provide a context to reflect on their previous encounters with education. While some phenomena understandably only exist in China the thesis hopefully provides an opportunity to sensitively perceive cultural and developmental gaps between American and Chinese art education. However, human's growth shows a lot of similarities beyond certain cultures—it is a specific case study, but also has some referential value.

In Chapter Three, a literature review on cognitive development and art education was conducted. It is easier to walk on the road that has been paved by precedents, especially giants in this field, such as Lowenfeld (1952), Eisner Elliot (2002), Arthur Efland (2004), etc. A study of their masterpieces and some new findings in cognitive sciences formed a basis for further exploration.

Chapter Four includes an analysis of the US National Core Arts Standards. The nationalartstandards.org provided a customized handbook for educators, and for this thesis, the scope focused on Visual Art, pre-K-12. By describing its contents, targets, detailed setting, value orientation, and scientific roots, an overview of art education was drawn as understanding at the same time. Then, a comparative analysis is used in (1) the comparison between National Visual Art Standards (2014), National Media Art Standards (2014), and Ohio State Art Standards; (2) a brief comparison of American and China's different educational culture.To better understand NCVAS, it is also necessary to compare it with other standards, like the Ohio State Art Standards (2012 & 2021). What's more, the author conducted interviews with frontline K-12 art teachers to observe whether there is a gap between theories and practices.

The thesis's final chapter is mainly a discussion and conclusion of lessons learned from the research. Advice for policymakers and educators and transferrable applications in diverse cultural contexts are explored.

In 1997, 20,280,000 babies were born in China, and I was just one of them, among more than 100,000,000 newborns worldwide. In a relatively paradoxical state, being a negligible fraction of the whole generation, I am also the only "one" in my family. Almost every child like me was born with the eager hope—hope the new life can become a person of honor also hope the little existence can blossom the whole family—especially in a rapidly developing country. China has a long tradition of attaching great importance to education, which is regarded as the only way to change one family's fate for a long time. The Imperial Civil Examination System, built in the Sui Dynasty, lasting for about 1600 years, was the most important way for ordinary people to climb up the social ladder. Today, we still have the unified entrance exams, which could almost be regarded as the most equal systems—regardless of family backgrounds, personal experiences, or any prerequisites.

Figure.1 Song Imperial Examination (WikiPedia)

Figure.2
Photograph of Children's Palace, Beijing,
1990s, by Bruno Barbey

training, all kinds of instruments. (3) physical education: dance, ping-pong, football, and Kungfu. (4) others. Nowadays, young kids may also have to learn Mathematical Olympiad or programming. In all, where there is demand, there is supply. It is the course providers who are most up to date instead of those official educational institutions.

Usually, a kid will study about 2–3 skills at kindergarten ages (like painting + dance + one instrument) and maintain approximately 2 specific skills after entering 3rd grade of elementary school (like sketch + violin). Due to the heavy academic workload in middle school, the time available for extracurricular training is drastically decreased. Most students will give up learning their specialties then, except students who want to enter art majors. As my mother told me, the tuitions for large-scale art classes at Children's Palace were not expensive, but

I have been vehemently working for endless competitions throughout my domestic student life. This stressful atmosphere is almost a strong character of this period of time — until the day China reached the balance between resources and mode of distribution. If possible, I would rather use the pronoun "we" than "I" — because my own encounter also reflects what our whole generation has experienced. But for this thesis, I will try to dig into the "case study" of mine.

My maternal grandmother and paternal grandmother are both elementary school teachers. Since I could remember, they had taught me prior to my formal education. I remember that my grandma taught me addition & subtraction, and phonetic alphabet in kindergarten, which are actually the required contents of elementary school. That was and still is a way for family members to let kids surpass their peers — up to when the teaching contents went beyond family's capacities. I do not intend to criticize this phenomenon because limited resources and a large population compel us to get prepared as early as possible. Education, work, marriage, offsprings are all racing tracks that no one can quit or stop — or the generations' accumulated progress would disappear like foam.

Young parents would also pay considerable tuition to let children study skills in extracurricular classes. In my day, the young mainly studied in Children's Palace. And the Children's Palace offered a very complete menu, including: (1) art: traditional realistic or impressionistic painting (landscape, flower & bird, figure), western painting (sketch of plaster geometries/still life/portrait, gouache), and children's painting. (2) music: vocal

supporting private lessons may take up to 20–25% of family income, not to mention the material fees. Just days ago, my cousin told me how much he admired me that my parents could spend ￥50 (about $8) on one sheet of paper in my childhood. And near entrance exams, the payments would be much higher: my family spent ￥10,0000 (about $16,000) on my university-level art entrance exam training, which is about a year's family income in 2014 to 2015. In contrast, my university charged ￥1,0000 (about $1,600) for one year. Luckily, I was so glad that I passed the exam once instead of repetitively wasting my parents' savings. However, the cost for music-specialty students is on another level. Not only one single instrument is expensive, but as students grow older, they need to update instruments (like from 1/4, 2/4, 3/4, to 4/4 size of violin). It is a pervasive sense that visual art entrance exam training costs a car, while the one for music specialty costs an apartment. Also, even if they cost so much, students cannot be guaranteed admission.

The above paragraphs indicate that Chinese families were willing to seek a promising future for their children at all costs. Nevertheless, kind of strange though, parents who coerce children into studying these skills are also ones who force children to quit specialty learning. While they act under the cloak of "all for children", they at the same time urge children to grow up according to their requirements, regardless of children's will.

"You learn this for yourself."

"You need to broaden your horizon, cultivate your own hobbies, and edify elegant sentiments in order to acquire a complete personality."

"It's time to quit extracurricular studies since you cannot feed yourself on that, and the entrance exam is coming."

Not suprsingly, my mom repeated these words to me.

What a paradox!

Craving to immerse in transcendent experiences on the one hand, we have to bow to reality on the other hand.

My art study career was suspended for a year after entering high school. Before high school, my academic performances were always top 3 in my class. Teachers and my relatives expected me to achieve some great things, and good drawing skills were considered additional. This gave my mother the vision that I should only rely on my academic performance. Not a single person who studied art proved to be "successful" as we knew. All reasons together, my mother strongly opposed me studying art after entering high school. Putting her attitude aside, I was overwhelmed by the crazy non-stop schoolwork. Back then, we got a 24-hour rest every two weeks; beyond that, we had classes from 6:45 am to 22:50 all day. And I could hardly ever finish assignments—too much! Art, thus, became my only breathing space. In addition, social networks made me realize that the world is so imbalanced that many people do not have to face such fierce competitions as I do.

I would never like to go back to that time, or even memorize that.

In addition, I was strongly defeated in my first year of high school. In middle school, I could often reach 1st place in my class. However, my high school collected the best students all over the city. Competing with so many excellent students, I was no longer exceptional. Historically, only top1 or top2 students of the entire school could be admitted to Tsinghua or Peking University. I was far from that rank, no matter how hard I worked.

The feeling of being defeated lingered in my mind all the time. Why did the student sitting behind me understand mathematics

reasoning so quickly? Why could the front-row girl answer physical calculating results just after the teacher threw the question? Why could that student get 96 scores while others almost all failed the test? Why couldn't I understand questions after the teacher had analyzed them? Besides those self-doubts, there was suspicious noise around us like, boys are better at science and engineering than girls, or only losers choose liberal art majors. And I was truly stuck by the hypothesis that "girls develop faster than boys in middle school, while boys would surpass girls in high school." I never wanted to admit that but my only encounter to some extent proved that.

Considering my advantages and disadvantages, I thought I should not compare my disadvantages with others' advantages. Only maximizing my strengths could I reach the top level in some aspects. I tried to enter the best academies in a smarter and more relaxing way.

Luckily enough, I finally persuaded my parents, and they agreed to support my art study. And I did pass the art entrance exams of Tsinghua University and the Central Academy of Fine Arts, which are the best two of three art schools in China. Especially pleasing, I got 1st place in the sketch subject of CAFA. Tsinghua is a comprehensive university, while CAFA was an exclusive art school. All people around me urged me to choose Tsinghua because of its reputation and supreme status among all Chinese universities. Due to an accidental combination of circumstances, I went to Tsinghua instead of CAFA, though I did not intend to meet families' expectations subjectively. It is undeniable that young generations have the responsibility to provide adequate returns on the elder's investment. That was when the seeds of despair were sewn.

Figure.3
My practice during training for art college entrance exams;
and I drew this in the Tsinghua Color Subject Exam

I will not deny if anyone criticizes me for being cynic or insatiable. I did struggle in Tsinghua, especially during the 1st and the final year. In a prestigious comprehensive university, what a marginal discipline art is! The atmosphere forced us to pursue utilitarian ends that are intrinsically in conflict with the transcendence of art. This kind of imbalance is also reflected in teachers' teaching and assignments. (Then I learned from my friends who studied in exclusive art academies that they were facing the exact dilemma as me.)

I was a passenger,
not a returner.

And Tsinghua, the best university in China or Asia, collected the best students around the country. Some students were nurtured in rich regions like Shanghai and Beijing. When we had common

required English courses together, I was so shocked to know that they had high school courses taught in English. Also, overseas travel courses are normal for them. Developing discrepancy, not only in regions, but also in capacities, drives me in deep anxiety. I felt I was so terrible and had no hope in life. Was I inherently so terrible or were my potentials not correctly being exploited?

In my gloomy university life, there were few glimmers of salvation: I am genuinely grateful to be guided by several professors — they told me to observe nature with a full mind, find myself, follow my heart, and forget the outside noises. However, I find it hard to move countercurrent — especially after discovering that those who focused on themselves achieved worldly success in turn. This period's reminiscence is full of pain, even though I recognize that I honed myself from this greatly.

In reflecting upon my past study, I can hardly say that I had the benefit of personal agenc — I was pushed forward by anxiety and competition. Sometimes I felt painful for being unable to obtain some advanced knowledge, and being tortured for witnessing my disappearing advantages. All these lead me to an assumption: if my potentials were developed in the right time and situation, would I live an easier life and acquire better results?

My testpaper of sketch subject in Tsinghua AAD entrance exam was selected to be listed in the collection. And four years later, I did not submit materials of my graduation project so that this book was my own connection with AAD.

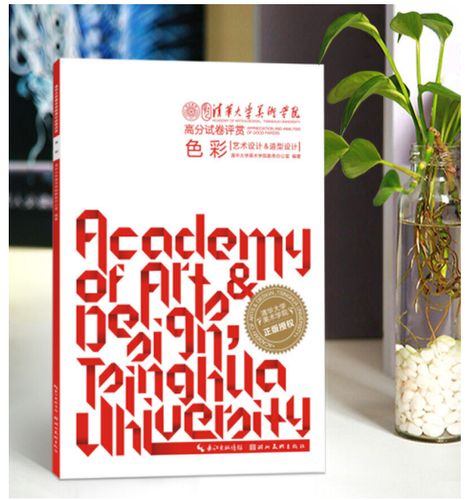

Figure.4 Excellent Testpapers in Tsinghua AAD Entrance Exam (2015)

Cognition and Art

Cognition, by definition, is both the mental processes and the product of these processes, and it is not only rational thinking and understanding (Marriam Webster Dictionary, 2020) but also emotional perception and sensation (Oxford Dictionary on Lexico.Com, 2020).

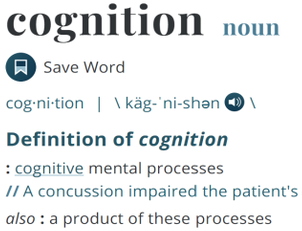

Figure.5 Cognition Page, Marriam Webster Dictionary

To better understand what is happening in human minds, inter-disciplinary perspectives have been widely used by art educators in researching historical and critical issues (Chalmers, 2004). This thesis will focus on the intersection of Cognitive Sciences and Art Education.

Historically, new findings in psychology and cognitive sciences facilitate progress in education (Efland, 2004)—theories of Freud, Piaget, Vygotsky, and many other schools provided new perspectives and approaches for Education. However, the status quo remained dualistic, in the tradition of western philosophy: only forms of literacy or numeracy contain cognition, while arts were expelled into non-affective and less important fields (Fauconnier & Turner, 2002). That is not

true, as Eisner (1979) indicated, school curriculum includes three parts: explicit curriculum, implicit curriculum, and null curriculum. Those ignored are affecting faculty' and students' subconsciousness greatly.

Arts facilitates students' study motivation and provides multiple perspectives for them to understand other kinds of information (Stevenson and Deasy, 2005). Especially, very young children usually find it hard to express themselves via verbal language (Protnerough, 1983). Thus, children's artwork is a significant way of providing insights into what they know (Hale, 1996). As Melnick and co-authors (2011) indicated that "the arts and non-arts content and skills are best taught in tandem (p.11)", Efland (2004) also emphasized the necessity of building an undivided world—connecting body and mind, thinking and feeling, individual and social context.

Art contains much abstract thinking and requires the ability to select and balance materials. Working in art develops one's temperament of tolerating the unknown and enables someone to judge freely; it also makes effervescent existences eternal; lastly, art is the shelter,where everyone could find peace in the inner world from the boisterous outer world (Eisner, 2002). Now, it is time to redefine "art" and "artist". "Neuroaesthetics" is a recently built terminology, later developed a derivative term "neuroaesthetician". These terms argued that artists work in a scientific way, where artists need to activate certain brain functions and nervous systems of the audience (De Smedt & Jucker, 2018). In response, we need to update our understanding of art: art is a type of research because painting, sculpture, performance, or others arts are all forms of knowledge (Rolling,

2006). For example, portraiture is one qualitative research method (Davis, 2003).

"Artist-researcher" is another advanced identity, and art is regarded as a "mode of thought", which Rolling (2006) described as:

> We are free to grasp the dimensions, explore the perimeter, cross over the borders and circumnavigate that which internally, cognitively, affectively takes place. We are free to create for ourselves and for others "a format into which experienced events can be cast in the attempt to make them comprehensible, memorable, and shareable."
> (Olson, 1990, p.12)

Artworks contain the most complicated and delicate forms of thinking, and to create this kind of knowledge requires numerous mental activities, of which "perception is, in the end, a cognitive event." (Eisner, 2002, p.xii)

Key Theories of Cognitive Development

"A truly integrative science of art can only be interdisciplinary and must take into account both cognition and culture to achieve a better understanding of why humans produce and enjoy art." (de Smedt & Jucker, 2018, p.3) New disciplines like Neuroaesthetics or majors like Art and Science, Design and Technology are inviting artists to discover new developmental orientations, or to say, out of survival—artists have to

explore the more extensive range to combat the ossification of outdated "Arts".

After accumulating for years, in 1989, President George H.W. Bush announced the 1990s to be the "Decade of the Brain". Later, countless findings of how brain functions arised. These findings have been widely applied to clinical treatments, while these in Education are rather rare (Melnick et.al, 2011).

Kail (2004) supposed that cognitive development comprises two perspectives: a global view and a domain-specific view. For example, Piaget and Gardner might stand for the former type, while Noam Chomsky and the separated school subject represent the latter.

The history of cognitive sciences could be primarily concluded into six stages according to Efland (2004): The first wave started in the late 1950s, theorists compared human brains with the most advanced technology back then, which was the computer. Twenty years later, the gap between abstract thinking and bodily sensation began to coalesce, especially proved by new findings in linguistics. Furthermore, around the 1980s and 1990s, constructivism ulteriorly challenged the traditional dualism of "objective" language and "figurative" language and argued that metaphor is pervasive in the usage of language. In the view of constructivists, the social context also contributes to learning results, as "integrated whole works greater than the sum of its parts." Efland also summarized the development in the 1990s using Linguistics scholars Lakoff's (1993) emphasis on the significance of "metaphor" as "based on underlying conceptualizations of reality" and "involving a mapping across

conceptual domains." (Efland, 2004, p.754) Also, Efland pointed out Lakoff's opinion that words are not the only form of metaphor since "visual images are also forms of thought" is provocative." (Efland, 2004, p.754)

Advanced technologies aid scientists to explore how the brain works at the most complex but subtle level. Neuroimage (de Smedt & Jucker, 2018), Brain Imaging Technology (such as CAT scans, PET scans, MRI, and fMRI, etc.) (Peterson, 2005), Eye-Tracking ("Dark-pupil tracking") (Fox & Faulkner, 2017), and other technologies are uncovering the mystery of brain functions. Not only cognitive processes behind these activities were revealed, but the mechanisms of obtaining such skills were also disclosed (Fox & Faulkner, 2017). It is true that the human brain has excessively unexploited potentials. With the help of those technologies, maybe one day we can reach a state where the human mind is "omniscient." (Though it may cause ethical problems, currently, benefits overwhelm the disadvantages.)

Figure.6 A full size MRI-scanner

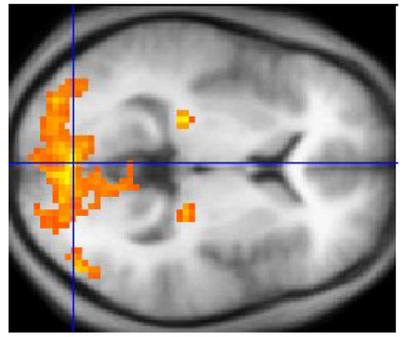

Figure.7 fMRI picture

Figure.8 EEG with test person

Figure.9 Ct Scan

The testified functional domains support Gardner's (2011) multiple intelligences theory: certain neural organizations tend to respond and process specific kinds of information.

For example, decades ago, scientists found that the left hemisphere deals with language, analytical and sequential thinking, which are of the rational subjects; and the right hemisphere takes charge in spatial thinking and visual-motor skills, in other words, arts or physical training (Silver, 1981). Soon the research moved into more subtle areas, here are several terms: posterior areas of the brain, the temporal-parietal junction, and the parietal lobe, midbrain superior colliculus, extrastriate visual regions (Berger, 2011), neocortex, or the Molar level. Though these words are new to most readers, it is important that those terms are evidence of new progress in neuroscience (Gardner, 2011).

Artists have combined neuroscientific findings into art critique, de Smedt and Jucker (2018) have found that the primary visual cortex specifically responds to horizontal or vertical directions, which constructed the basis of appreciating Mondrian's painting. Also, V4 is the area fired when admiring colorful paintings.

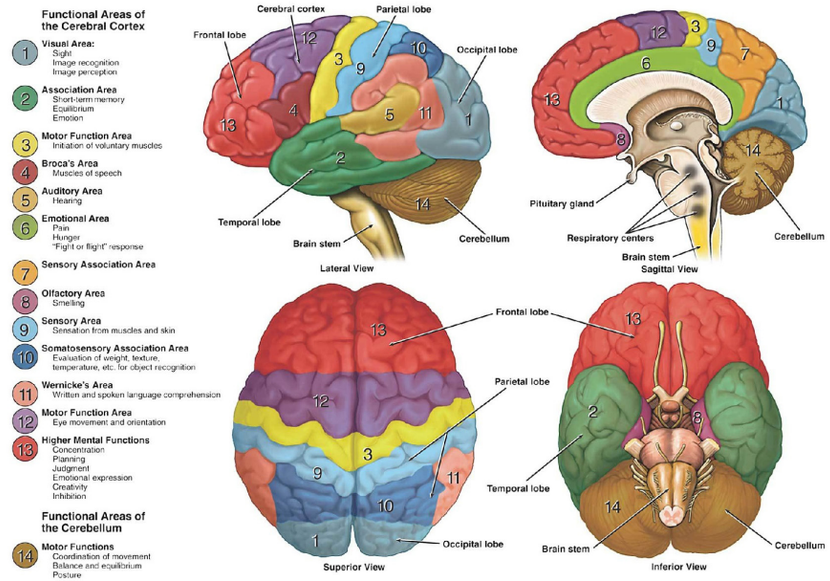

Figure.10 Biran Areas

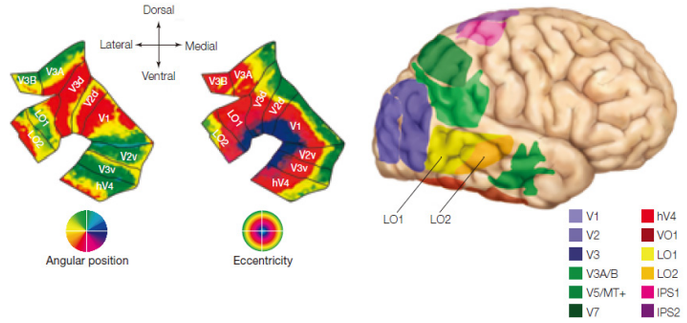

Figure.11 Visual Areas

Based on the discoveries in neuroscience, psychologists or other scholars tried to interpret the panorama of brain functioning. Arnheim suggested that sensory perception conceives cognitive activities like selecting, receiving, generalizing, etc., which means what was regarded as the contrary of cognition contains

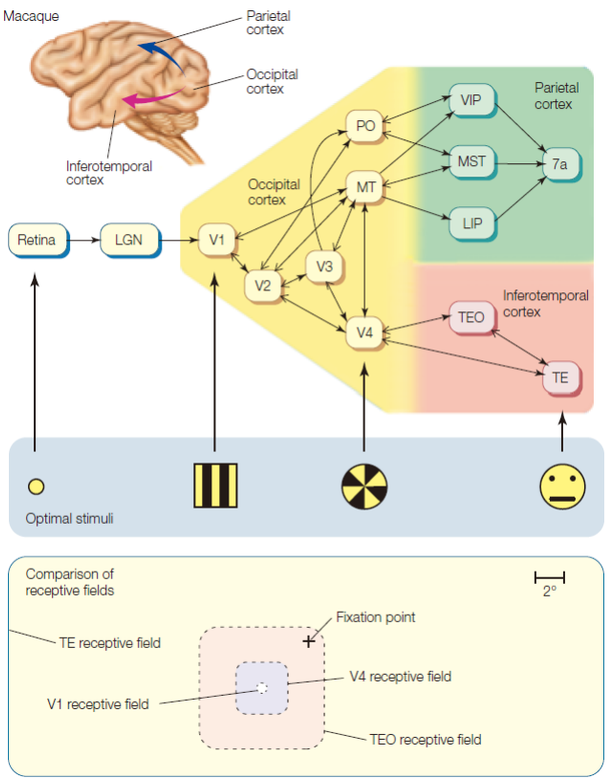

Figure.12 Visual Areas Fuctioning

cognition (Parsons, 1998). Gardner concludes that Brain and Biological Science especially shed light on these two issues regarding art education: one is the testified "flexibility" or "plasticity", referring to one's ability not being preordained; the other concerns the essence of development—whether a human has infinite or limited intelligence.

From the perspective of genetics, C. H. Waddington (1978) used the notion of "canalization" to describe the prevalent developmental path of nearly all organic systems, which could be observed across species. Prasannakumar and Saminathan (2016) suggested sensory integration is the nature of brain

I remember when having Dr. McKeeff's Cogneuro classes, he would perform patients with various brian damages to let us dignose which part of brain was damaged. This truly enhanced my understanding of the closelu-related brain functions.

functioning, where external information is selected and transmitted by certain nerves to the corresponding cortex and is processed with other kinds of information by the brain. In the procedure of integrating multiple kinds of neuro codes, the brain and the body reach harmony, and arts especially augment cognitive capabilities.

Among other interpretations, Dubinsky (1991) and colleagues came up with the theory APOS (action, processes, and object). In detail, these three stages are obtaining information or objects, recognizing and processing (not necessarily responding), and generating a whole schema, or further deciding to take actions. Another explanation borrowed from Piagetian stage theory—Tall (1995) speculated there are two stages and they exist at the same time. For additional explanation, objects are first recognized as visuospatial gestalts, then their properties are examined and classified into categories and hierarchies.

In the lens of Cellular-level Biology, the "intelligence" could be observed and read through the activities of nerve cells: (1) to engage in learning, only a few (as less as 50) cells are needed; (2) learning processes shift the synaptic connections between cells, and (3) the concentration of chemical transmitters sent by the terminals of neurons; (4) finally, training by training, some mechanisms are enhanced and thus preserved (Kandel, 1982). Kandel (1982) also pointed out that the brain mechanisms are undeniably based on a genetic or biological level, but learning and environmental alterations can contribute to new behavioral forms.

Researchers did not merely stop at the theoretical fields—they

have found much evidence of a correlation between art training and improved cognitive capacities. Winner, Schlaug and coauthors have discovered alterations of brain circuits in children who received musical training, contrasted with the control group. Also, relevant musical motor and auditory skills are improved, which is called "near transfer." Spelke (2009) further reported students who intensively participated in musical training later performed better in geometry tasks. Wandell (2008) also suggested that experiences of visual arts might correlate with children's math calculation abilities according to their initial data. Posner and Patoine (2009) think that maybe adjacency accounts for the "near transfer": when the music network is activated, neighboring areas dealing with mathematics are also influenced.

Tang and others (2009) have found that brain functioning could also be changed via specific meditations, which "can produce changes in the connection between the brain and the parasympathetic branch of the autonomic nervous system," and "can lead to improvements in the same aspects of executive attention." (Posner & Patoine, 2009, p.2)

The timing is also crucial for one's development. Van Eeden and van Vuuren J (2017) emphasized the beginning first or second year is pivotal for neurons and synapses, after which no such boom would exist again. Additionally, according to Grantham-McGregor (2007), the visual cortex and auditory cortex and the areas in charge of language reached the climax at this time. In this period, appropriate intervention like auditory or visual stimulations will impose positive effects on infants' growth (van Eeden, R. & van Vuuren J., 2017).

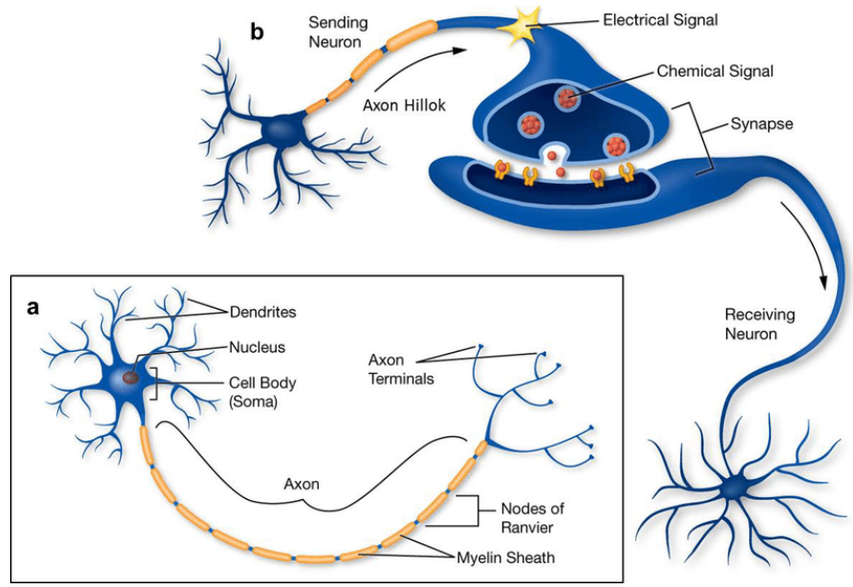

Figure.13
a) Structure of neuron with axon, dendrites and synapses.
b) Structure of a synaptic connection

What should be paid more attention to is the experiments on brain stimulations, and one of which is environmental enrichment (EE) investigating how physical and social surroundings impact brains. Due to ethical reasons, many experiments in this field were executed on laboratory animals such as rats. From 1964 to 1966, Diamond and colleagues observed the 3.3-7% thicker cerebral cortices of rats raised with environment enrichment with 25% more synapses, and Glial cell increase 12–14% in the number of each neuron. Other data also illustrated how EE stimulated brains: glial cell nuclei's volume elevated 37.5% per synapse and 63% higher per neuron; capillaries are broadened from 4.15μm to 4.35 μm while the distance between a neuropil and a capillary were shorten form 34.6 μm to 27.6 μm in controls; the mean volume of mitochondria increased 20% for each neuron (Sirevaag and Greenoug, 1987). Ickes and other scientists (2000) indicated that "EC rats have a higher density of immunoreactivity than IC rats for both low and high affinity nerve growth factor

(NGF) receptors in the basal forebrain" and they also discovered they biochemical basis as "We found that NGF and BDNF levels were increased in the cerebral cortex, hippocampal formation, basal forebrain, and hindbrain in EC animals compared to age-matched IC animals." Furthermore, EE also contributes to human traumatic brain injury (TBI) as it accelerates neurogenesis (Kovesdi et al., 2011). Besides environmental enrichment, Olson and others in 2006 examined how EE and voluntary exercise (VEx) function differently in increasing "adult hippocampal neurogenesis and improve spatial learning ability" as "VEx leads to the convergence of key somatic and cerebral factors in the dentate gyrus (DG) to induce cell proliferation." For educators, these shed some light on the teaching material options, since abundant resources supports children's acquisition of literacy (Neuman & Roskos, 1990).

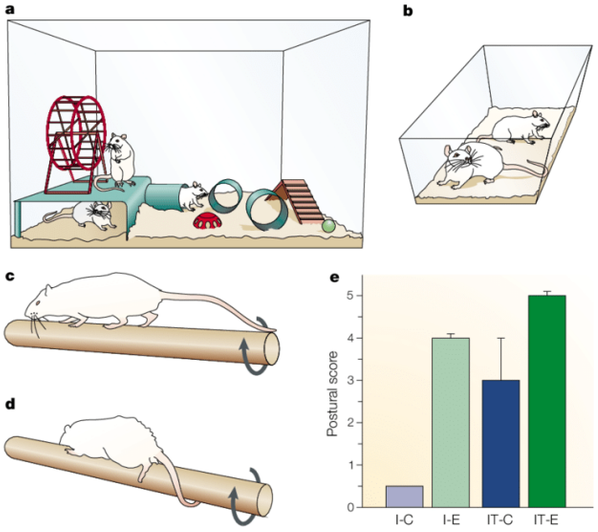

Figure.14 Environmental enrichment

Developmental Stages and Instructions

In *The Rhode Island Professional Teaching Standards* (2007), Standard 3 and Standard 5 both require teachers to create instructional opportunities to best suit students' developmental stages, as "design instruction that meets current cognitive, social and personal needs of their students", "meet a variety of developmental levels of students in the class" and etc. It is teachers' primary responsibility to respect children's objective reality and find ways to galvanize their potential.

There are many differnt systems of developmental stages and they will continuously be renewed with the breakthrough of observant technololgies.

When discussing developmental stage theories, Piaget (1963) is who we cannot circumvent. In light of Piaget, there are four periods: sensorimotor intelligence (0–2 years), preoperational thought (2–7 years), concrete operations (7–11 years), and formal operations (11–15 years.) He also stated that the overall coherence is more important than the individual stages, of which the latter helps observe.

If we broaden the range of application to the most normal sense, the developmental stages are widely recognized as early childhood (2–6 years), middle childhood (6–12 years), adolescence (12–18 years), young adulthood (18–30 years), middle adulthood (30–65 years), and late adulthood (65+ years). There are different developing tasks at each stage (Kaya, 2019).

Parsons (1987) focused on aesthetic development and concluded in five stages: (1) at the beginning, there is no difference between good art or bad art; (2) before 9–10 years old, the particular cognitive structure of differentiating good or bad arts is formed based on the imitation of given examples; (3) in adolescence, teens can discern personal expressions in spite of the subject

Figure.15
Suitable kits for Children in Scribbling Stage and Schematic Stage, according to Lowenfeld.

matter; (4) later, teens are more sensitive to art styles; (5) finally, social context is taken into consideration (Efland, 2002).

According to Blanck (1990), Vygotsky's classifications appeared simpler, which only contains two stages, the first being low or basic level of attention and perception, the latter being the higher-order level of mental processes acquired from cultural context. Blanck criticized his point of view that it splits the inferior and superior mental processes, which are indeed from the same origin but performed differently.

It is Lowenfeld (1952) that proposed detailed developmental stages regarding art education: 2–4 years old, the Scribbling Stages; 4–7 years old, the Pre-schematic Stages; 7–9 years old, Schematic Stages; 9–11 years old, the Gang Age; 11–13 years old, the Stage of Reasoning; 13 years, the Crisis of Adolescence could be seen in creative activities. Lowenfeld also provided several evaluating indexes: intellectual growth, emotional growth, social growth, perceptual growth, physical growth, aesthetic growth, creative growth, and etc. (Certain stages do not involve several kinds of growth.) In each stage, best-fit materials are also suggested.

To efficiently evaluate student growth, many states came up with State Standards like the Ohio Learning Standards for Fine Arts (2012), which is widely utilized in Art Education today. The Peabody, Beery VMI, PDMS-2, and other experimenting approaches also help educators to assess students' achievements. These scales are different in criteria: some strict, some loose, each fitting different groups, and the results also vary.

Not only is it complicated to assess students' artistic development, the factors of development are also substantial. Time, phase, growth, maturation, hormones, heredity, age, readiness, emotions and social environment, culture, economics, and others are all influencing students' development, and the list never seems to be exhaustive.

Previous criteria are no longer appropriate today, as researchers suggested that"the academic expectations of today's kindergarten are set similar to the achievement levels of first grade's 20 years ago." (Almon & Miller, 2011; Guddemi et al., 2014; Miller & Almon, 2009; Faugno, 2020.) Therefore, updates in education are strongly needed.

Connecting Cognitive Theories with Art Education

Education is the kind of national machine that shapes human mind and exporting workforces, during which the most crucial values are passing generation by generation. UNESCO (1972) reported that most parts of the brain are left undeveloped, which means a human has extensive potential. Gardner's (2011) *Multiple Intelligence* theory challenged the traditional definition of intelligence with his list of six kinds of intelligence: linguistic intelligence, musical intelligence, logical-mathematical intelligence, spatial intelligence, bodily-kinesthetic intelligence, and personal intelligence. It is meaningful because if we adopt Gardner's theory, we no longer use a single standard to decide one's achievements and everyone could be assessed globally. One loser here could be a role model in another field, not only

individuals gain space of survival, the nation also gets multiple levels of labor.

Theories: transfer, mapping, metaphor & curriculum

Transfer is one of the most repetitive occurring terms in literature, meaning that the skills and ability students acquired from one specific domain can be carried over to other fields, through which the abilities are extended (Eisner, 2002). "Transfer" is still being studied, and cognitive scientists are exploring particular interventions that affect "transfer".

There are two kinds of transfer: near-transfer and far-transfer. Near-transfer is about enhanced adjacent function areas; for example, musical training may help improve auditory performance. Far-transfer is about relatively distant functions—no concrete causation has been testified yet, but with advanced technology, it will be clear one day.

It is worth mentioning that continuous training, or to say enough duration rather than certain kinds of training works better. Strong attention networks improve cognitive performance reversely. "The key to transfer is diligence." (Posner & Patoine, 2009, p2)

Mapping is more than simple acquisition but involves the process of connecting separated elements and building an understandable relationship (Efland, 2002). Something that otherwise would be hard to grasp can be caught in the "structural analog" with the help of visual navigation (Eisner, 2002). In teaching practice, the cognitive maps could be used as a

transition metaphor of schema, and the real "map", in terms of diagrams, charts, or sketches are evidence of cognitive activities (Skemp, 1987).

Once a person command the concept of schema or metaphoric projection, the world would be a level easier to understand and perceive.

Metaphor has been referred to above because it is the basic mechanism of most cognitive activities. Besides those established connections, metaphor helps people build connections to the unknown. As Efland (2004) described: "The tools or cognitive strategies that are entailed in this learning process include imagination as a schematizing function and its extensions by metaphoric projection." (p.770)

Bloom (1956) provided a taxonomy of educational goals, with which teachers can confine focus on specific teaching goals and adopt effective approaches.

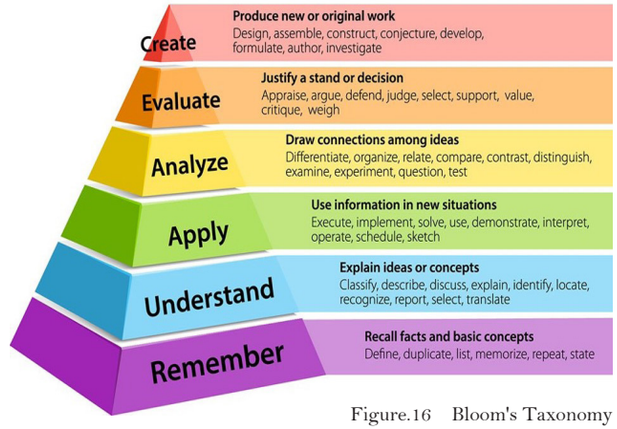

Figure.16 Bloom's Taxonomy

Curriculum is the media connecting teachers and students, schools and the society. Eisner (2002) accentuated, "the curriculum is a mind-altering device," (p.xii) each discipline providing its scheme or map of knowledge. The curriculum also bridges the subjective and objective worlds, materials and ideas are integrated.

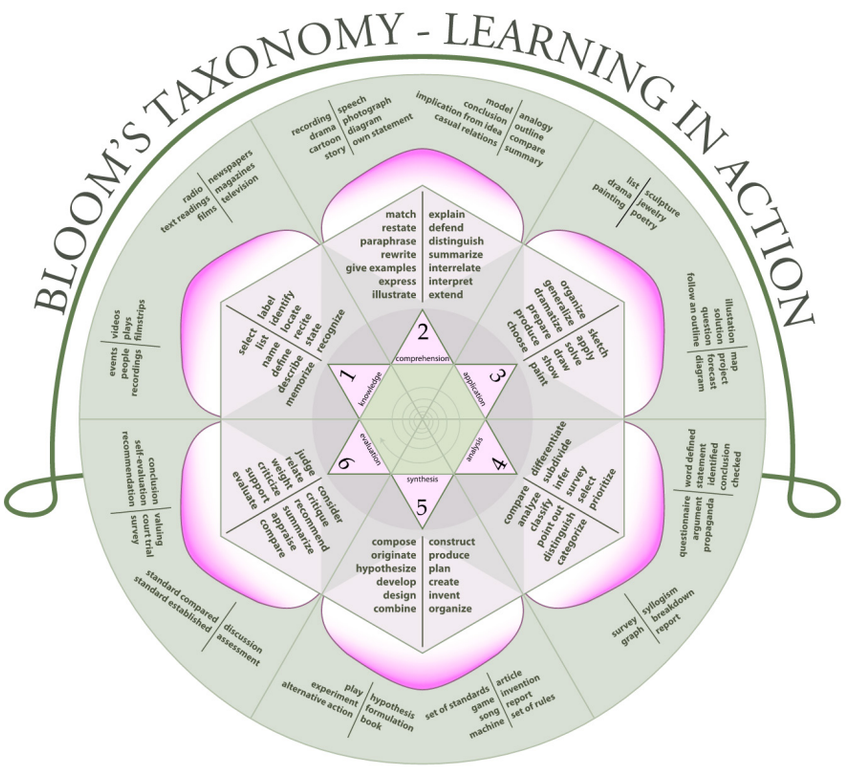

Figure.17 Bloom's Taxonomy—Learning in Action

Art Education Practices

There have been case studies studying the causation or correlation between Art education and academic performances. Overall, they have found some correlation between art curriculum and advanced performances, though the environmental indexes are extremely complex and further research is needed.

The Suzuki Talent Education Method

Japanese Violin Educator Suzuki started this program, where he gathered very young kids and their mothers. From birth, their kids will be immersed in an environment where about 20 selected masterpieces of classical music are playing all the time, and it is these pieces that they will learn to play. Later, kids and moms study how to hold violins and how to start playing. During the study, moms were highly responsible for keeping students making progress and constructing the atmosphere of family connections. Also, this Suzuki project asked students to compare with themselves rather than others. This project has nurtured many great violin players who are admitted by the top music schools. "One of thirty students beginning at age two or three will be able to play a Vivaldi concerto at age six and a Mozart one by nine or ten, and even the average student will have reached this competence but a few years later. (Gradner, 2011, p.394)" However, nearly none of them are inclined to be composers—the long training they have engaged in is far from creativity. Additionally, Suzuki Project is criticized for having a narrow range of aesthetics. But the Suzuki mode proved that "prodigies" could be replicated, and relative neuro-biological mechanisms should be studied—"To the extent that there may

be a critical period for the acquisition of musical competence, and to the extent that the brain of the young child is especially plastic for this kind of learning (Gardner, 2011, p395)."

Project Zero (1967–present)

The slogan for Project Zero is "learning in and through the arts," which could make understanding and learning visible. Project Zero is named after philosopher Nelson Goodman at the Harvard Graduate School of Education in 1967, "to reflect his belief about the state of research on cognition and the arts. (About | Project Zero, n.d.)" Though exact data of how this project facilitated students' development has not been found, the growing numbers in their annual reports could indicate that this project is highly attractive and keeps produce new findings. For example, in their 2018-2019 annual report, subscribers on social media including Twitter, Facebook, website respectively reached 29%, 18%, and 18% increase. The 18% growth compare with the number of international PD attendees in FY18 and the $156,000 scholarship awarded also suggested Project Zero's influence. (http://www.pz.harvard.edu/, 2021)

The North Carolina A+ School Program (1995–1999)

From 1995 to 1999, the North Carolina A+ School Program was sponsored by Kenan Institute of Art. This program is based on Gardner's Multiple Intelligence theory. In this program, art was regarded as the basis of every other discipline. The proportion of Art in the curriculum was greatly increased. Due to lack of common theory ground, this program was criticized widely. However, "following the initial three years

of implementation, schools meet growth goals. The School Performance Score increased by a full letter grade for each of the schools that entered the network in 2013." "The number of students achieving grade-level proficiency increases as students experience A+ implementation. In the 2013-16 cohort, the number of students achieving grade-level proficiency increased by an average of 22 percent." (the North Carolina Arts Council, in collaboration with the Department of Public Instruction, 2021)"

SPECTRA+

SPECTRA+ started in Ohio State, out of the 1990s' Cultural Action Plan. "SPECTRA+…was developed by Hamilton's Fitton Center for the Creative Arts. The Hamilton school district provides basic funding for SPECTRA+. Fitton provides training for school staff, some financial resources, and administrative support. Schools in New York and California have also adopted the program. (National Arts Education Public Awareness Campaign, n.d.)" "An empirical study compared students in a Spectra+ program with two groups of students in two alternate, non-Spectra+ programs in districts A and B to measure differences in creativity, academic achievement, self esteem, locus of control, and appreciation of the arts. Results showed that on creativity tests, Spectra+ children scored highest overall on the total test, originality, and resistance to closure. Reading and mathematics achievement scores were examined prior to and following program treatments. Spectra+ students showed no differences in reading improvement from Group A, but less achievement improvement than group B. Spectra+ males showed greater mathematics improvement than Group A as a

whole, while the Spectra+ girls showed the lowest mathematics improvement. There was no difference in Spectra+ and group B students in total mathematics achievement. (Luftig, 1994)"

The Arts in the Basic Curriculum Project (ABC)

ABC program located in South Carolina state, which provided in-residence artists in 1987. Though with ABC in the school curriculum, there was no observable improvement in students' academic performance, according to Seaman (as cited in Deasy, 2002; cited by Baker, 2013). But at least, it proved that arts are not negative influencers for academic performance. Also, $1,000,000 grants respectively was given to ABC program in 2013 and 2016 to support their study.

ArtSpace Charter School (artspacecharter.org, 2014)

Recognized by the State government and granted for 10 years, this Art Space Charter School aims to combine community with art education. It encourages the participation of family and mainly adopts visual art or performing art approaches. Though not significant, true improvements could be seen in ArtSpace School's student personality and math, English language arts and reading performance, as the figure below:

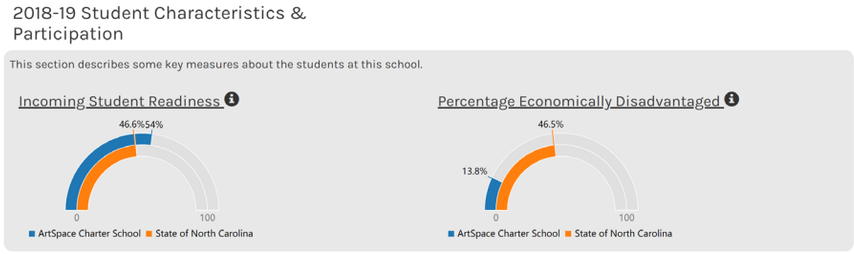

Figure.17 the ArtSpace NC School Report Card, 2018-19 Student Characteristics & Particpation, by The Department of Public Instruction in North Carolina.

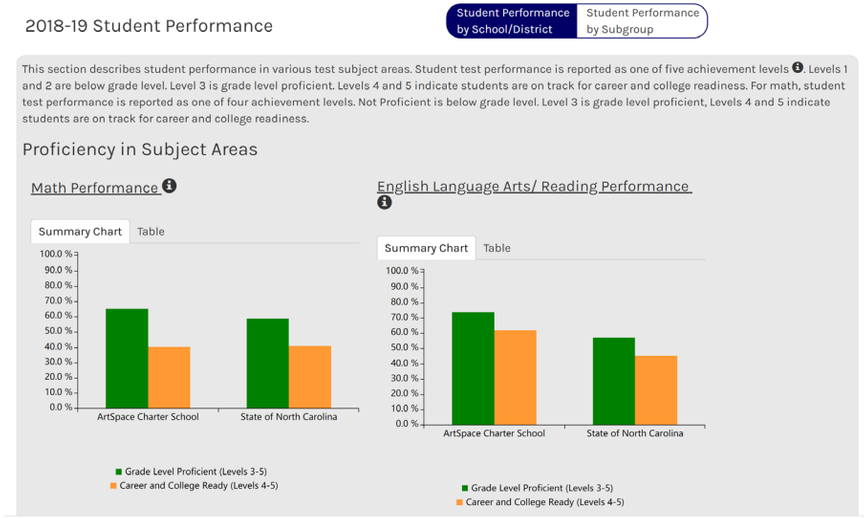

Figure.17 the ArtSpace NC School Report Card, 2018-19 Student Performance, by The Department of Public Instruction in North Carolina

Multisensory Integration Approach Mode

"Multisensory Integration Approach Model contains three parts: the first part is instructional part, second part is processing part and the third one is learning outcome part. Instructional part includes seven steps. There are relating new information to prior knowledge, Focusing attention to the information, developing sensory connection, Organizing the information, Expanding sensory images, Structuring the information, and Practicing recall. The above instructional strategies develop stimulation, sensation, Attention, Perception, Imagery, conceptualization, and memory. The learning outcome part contains from low level sensory integration (visual- Auditory) to high level sensory integration (Visual-Auditory-Tactile-Olfactory-Gustatory). The investigator regulates information processing of the students in the brain through the Multisensory Integration Approach Model".
(Prasannakumar & Saminathan, 2016, p.629)

A Brief Critique

The academic field endeavors to find the optimal education to cultivate decent people. So far, they have contributed to various theories and experimenting programs. Among those, there are several factors that have not been fully discussed. First, in the socio-cultural context, many case studies that proved to be successful are not applicable in other cultures, because some social bonds only exist in certain cultures. Second, when testing educational outcomes, socioeconomic factors have to be taken into consideration. Third, the impact of technology has been underestimated—tools shape our mind in the way we did not even notice. It would be hard for people who lived decades ago to imagine how the internet changed our lifestyle. Fourth, except for the environmental factors, the motivation or desire of the receiver works much more efficiently—even if we provide the most abundant resources, it will not help students who do not want to study. Fifth, about the exceptions, prodigies and students who lag behind cannot be ignored in the class, whose proportion is always noticeable. Finally, regarding ethical problems, since each group has its own traditions and histories, we always need to respect them.

Chapter 4 US National Visual Art Standards & Cognitive Theory

Introduction: Through a Developmental Lens

The extent of "success" on the one hand depends on the complexity of targets, and on the other hand relies on the ability of participants. For example, if a child had not developed a mature sense of dimension, teaching this child to draw a three dimensional work would be of little value—not only no progress could be made, but it would also frustrate the student. Given that suitable benchmarks could develop students' ability and establish their confidence, it is worthwhile to examine if there are detailed and applicable guidelines that fit students' developmental level and potential. Social development, emotional development, kinesthetic development, above are all based on physical development. Somewhere in between, a bit higher than physical level, cognitive level could be observed via external psychology approaches and neuroscience methods. Therefore, prior to my analysis of the National Visual Arts Standards I thought that it would be of value to set a context for my analysis by identifying in chart form what I consider to be key pedagogical strategies informed by scholarship and which apply to learners from early childhood to adulthood.

	Cognitive Development	Visual Arts Instructions
1 year	"Explores things in different ways, like shaking, banging, throwing; Finds hidden things easily; Looks at the right picture or thing when it's named; Copies gestures; Starts to use things correctly; Bangs two things together; ...Pokes with index (pointer) finger; Follows simple directions like 'pick up the toy'." (CDC, 2021)	"Give your child crayons and paper, and let your child draw freely. Show your child how to draw lines up and down and across the page. Praise your child when she tries to copy them." (CDC, Milestone Checklist, nd)
1.5 years	"Knows what ordinary things are for; for example, telephone, brush, spoon; Points to get the attention of others; ...; Points to one body part; Scribbles on his own; Can follow 1-step verbal commands without any gestures; for example, sits when you say 'sit down'." (CDC, 2021)	"Encourage empathy. For example, when he sees a child who is sad, encourage him to hug or pat the other child; Read books and talk about the pictures using simple words. Play with blocks, balls, puzzles, books, and toys that teach cause and effect and problem solving; Name pictures in books and body parts." (CDC, Milestone Checklist, nd)
2 years	"Finds things even when hidden under two or three covers; Begins to sort shapes and colors; ...; Builds towers of 4 or more blocks; Might use one hand more than the other; Follows two-step instructions such as 'Pick up your shoes and put them in the closet.' Names items in a picture book such as a cat, bird, or dog." (CDC, 2021)	"...Teach your child to identify and say body parts, animals, and other common things. ...Help your child do puzzles with shapes, colors, or farm animals. Name each piece when your child puts it in place. Encourage your child to play with blocks. Take turns building towers and knocking them down. Do art projects with your child using crayons, paint, and paper. Describe what your child makes and hang it on the wall or refrigerator." (CDC, Milestone Checklist)

Cognitive Development	Visual Arts Instructions	45
"...Does puzzles with 3 or 4 pieces; Understands what 'two' means; Copies a circle with pencil or crayon; ...; Builds towers of more than 6 blocks." (CDC, 2021)	"Read to your child every day. Ask your child to point to things in the pictures and repeat words after you. Give your child an 'activity box' with paper, crayons, and coloring books. Color and draw lines and shapes with your child." (CDC, Milestone Checklist)	3 years
"Names some colors and some numbers; Understands the idea of counting; Starts to understand time; Remembers parts of a story; Understands the idea of 'same' and 'different'; Draws a person with 2 to 4 body parts; Uses scissors; Starts to copy some capital letters..." (CDC, 2021)	"...Give your child toys to build imagination, like dress-up clothes, kitchen sets, and blocks; ...Use words like 'first,' 'second,' and 'finally' when talking about everyday activities. This will help your child learn about sequence of events. Take time to answer your child's 'why' questions. If you don't know the answer, say 'I don't know,' or help your child find the answer in a book, on the Internet, or from another adult. Say colors in books, pictures, and things at home. Count common items, like the number of snack crackers, stairs, or toy trains." (CDC, Milestone Checklist)	4 years
"Counts 10 or more things; Can draw a person with at least 6 body parts; Can print some letters or numbers; Copies a triangle and other geometric shapes..." (CDC, 2021)	"...Encourage your child to 'read' by looking at the pictures and telling the story...Keep a handy box of crayons, paper, paint, child scissors, and paste. Encourage your child to draw and make art projects with different supplies." (CDC, Milestone Checklist)	5 years

Chart.1 Cognitive Development and Visual Arts Instructions

6–11 years	"During this period, kids engage more in logical thinking and processing complicated information. The concept of time has been developed quite mature in this age. And based on this, kids are able to make plans. As they understand sequential order, they will know cause-effect and other logical relationships. But one big problem was that kids cannot sit still for long due to their limited attention. As grades reach higher, this phenomena could be ameliorated." (OpenStax College, 2014, p.315)
11–18 years	"In adolescence, the abilities they already had are enhanced. According to Piaget's (1969) formal operational stage, teens became able to conduct abstract thinking, moving beyond figurative thinking, Also, they'll start to change perspectives to emphasize with others. " (OpenStax College, 2014, p.323)
Adulthood	After the age of 18, cognitive development has not stopped. But it is no longer dramatic and students begin walking into society, so that I will end this here.

A Survey of National Visual Art Standards and Cognitive Theories in it

A Brief Summary of National Visual Art Standards

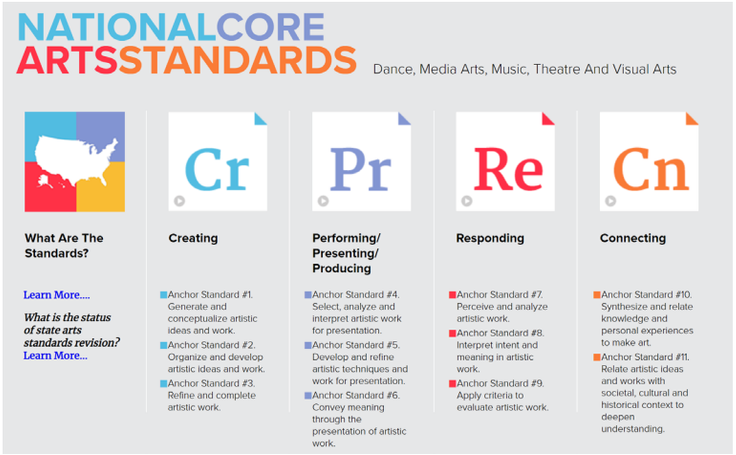

Figure.20 https://www.nationalartsstandards.org/

The National Visual Art Standards are a highly developed curriculum framework which obtain personal, social, historical, environmental, intelligent, and artistic guidelines for students' growth. There are four main categories constituting the national art standards: Cr (Creating), Pr (performing/presenting/ producing), Re (responding) and Cn (connecting.) According to Professor Sproll (2021), my advisor, the essential elements of inquiry-based art education involves the intertwining of art-making (creating) and interpreting (responding) with opportunities to have work viewed by others (presenting). While artists engage in seemingly individual investigation and experiment, the audience also responds to their artworks according to their personal experience. Those processes seemed to be independent but are in fact rooted in a social and cultural context, which connect every participant to a broader sense.

The NVAS framework involves three to five standards listed under each category, and they are organized according to a grade level sequence. In pre-K to K, the standards deal mainly with levels of consciousness—like knowing something is there. In elementary schools, students need to engage more in logical thinking like analyzing, identifying and finding evidence; in middle school, students are expected to connect art-making with social life and produce concrete artifacts or events; in high schools, it is expected that art class will became an elective so that students who registered art classes are preparing for professional art study, thus, this period the standards are transitioning into detailed and deep learning.

If the NVAS (2014) could be rigorously applied in K-12 art education, it could be imagined that the nation's art talent reserve would be extraordinarily abundant—the framework dissemble the entire art-making process of college level or professional level into applicable elements, so that any student who finished K-12 education could be endowed with all the basic abilities of creating, appreciating, presenting, curating, critic and making meaning in various contexts. And in the process of reaching all of the standards, we can infer that students will be strong in understanding and empathizing with each other, since they can admire beauty in life and knowing that everyone has a preference based on their personal understanding. The connecting and presenting and responding process also train students' communicative skills and the capacity to fathom others' attitude, especially in collaborative activities.

Content Overview

Standards of Visual Arts

Visual Arts here are defined as a more broad and basic range of traditional Fine Arts, which formulated the main content of art as a subject in K-12 education. To study National Visual Art Standards is more of referential value for K-12 teachers in practice.

There are two standards about Connecting: #VA:Cn10.1 find personal connection with art; #VA:Cn11.1, find societal, historical and cultural connection with art.

And 6 standards are about Creating: #VA:Cr1.1, think about making art; #VA:Cr1.2, try to make some art; #VA:Cr2.1, develop qualities for exploring approaches; VA:Cr2.2, understand right procedures of making art (ethics, copyright, safety, freedom & responsibility); #VA:Cr2.3, bring meaning into environment and daily life via art; #VA:Cr3.1, refine artworks after critiques.

For Presenting, drama and dance inherently emphasize one-time presentation as their formal show, but the presentation of visual art also informs how the audience feels and understands art. #VA:Pr.4.1, think about presenting art work; #VA:Pr.5.1, understand complex conditions for presenting art work; #VA:Pr.6.1, understand cultural functions of artwork presentation.

Finally, Responding offers students another perspective beside that of creator: #VA:Re7.1, find art and aesthetic experiences in life; #VA:Re7.2, cultivate the abilities of analyzing visual features of art; #VA:Re8.1, gain insight including subject matter, details, and contextual information; #VA:Re9.1, be able to evaluate artwork on certain criteria.

In Comparison with Media Arts Standards

I believe it is important in this review of the National Visual Arts Standards to also reference the National Media Arts Standards as this framework is also closely related to students' cognitive development. That is to say, the dexterity with which students manipulate media represents their multi-level development. Regarding Media Arts, as stated in the introduction of NVAS (2014), this genre was distinguished from visual arts: visual arts remained in the field of traditional fine arts like painting, sculpture and photography; and media arts are more inclusive and professional, most of which are preparing for research interests in college level or above (p.41/90).

Two Media Arts Standards involve Connecting: #MA:Cn10.1, use medias to create meaning and share cultural experiences; #MA:Cn11.1, relate media artworks with life and interact with social issues.

In terms of Creating, Media Arts Standards emphasize more on the interaction with media: #MA:Cr1.1.1, conceive ideas for media artworks through experimenting materials; #MA:Cr2.1.1, plan for media art; #MA:Cr3.1, prepare contents for making media arts, and form these into impactful presentations.

Somewhat different from visual arts, media themselves are also content, so that choosing proper media is more important: #MA:Pr4.1, mix and present various contents into a unified media art format; #MA:Pr5.1, develop skills, abilities and techniques in making media arts; #MA:Pr6.1, present and give feedback for the presentation;

Also, responding to media arts should also include the consideration of media themselves: #MA:Re7.1, perceive how contents and presentations of media arts work; #MA:Re8.1, interpret media artworks in multiple dimensions; #MA:Re9.1 evaluates media artworks on specific criteria.

In comparison with the Ohio State Visual Art Standards (2021)/ Ohio Learning Standards for Fine Arts: Visual Arts (2012)

Figure.21 Ohio Visual Art Standards, 2012

The State of Ohio is renowned for its art education, and many other states have adopted OSLSFA (2012) as their rubrics of evaluation. It is worth noting that in American education national and state standards are often parallel and complementary with states often either adopting national standards as their own as is the case with Rhode Island or borrowing from National Standards and adapting them for their own purposes. I argue that the similarities and differences between National and State standards is worthwhile studying. The most obvious distinction between OSLSFA (2012) and National Art Standards (2014) are that the former did not contain the categories of Presenting and Connecting, while separating Creating into perceiving/knowing and producing/performing. Years ago, the function of art was less discovered in the socio-cultural level—arts remained in the small field of closed-loop subjects.

Moreover, OSLSFA did not contain Media Arts until 2021, which is also the year of the author doing thesis research, and the Ohio State Media Art Standards (2021) are still in draft. Thus, at the time when the interviews were conducted, the 2021 version of OSLSFA has not been updated. (One interviewee, Kari, attached OSLSFA (2012) as the standards for evaluation in her teaching practice.) Also, comparing OSLSFA (2012) with OSVAS (2021), the hints of revising under NVAS (2014) are apparent. Another difference lies in the sections of age groups, NAS (2014) contains PreK and does not classify age groups in the form of every three grades. Indeed, I found the requirements for the four age

groups are kind of difficult to find differences. However, the age-different targets almost vanished in the newest version, OSVAS (2021) only contain two age groups, which are K-8 and High School. From this point of view, it is quite different from NAVS (2014).

2021 Draft Fine Arts Standards

The 2021 Draft Fine Arts Standards are still being revised.

Update: *Coming Soon*

Dance	Drama	Music	Visual Arts	Media Arts *(NEW!)*
2021 Draft Dance Standards	2021 Draft Drama Standards	2021 Draft Music Standards	2021 Draft Visual Arts Standards	2021 Draft Media Arts Standards
2012 / 2021 Dance Comparison Document	2012 / 2021 Drama Comparison Document	2012 / 2021 Music Comparison Document	2012 / 2021 Visual Arts Comparison Document	N/A

Figure.22 http://education.ohio.gov/Topics/Learning-in-Ohio/Fine-Arts/Fine-Arts-Standards

Analysis

In this section, I am going to discuss my observations and reflection on NVAS (2014) in the developmental lens. My analysis is structured in the following manner: (1) my concept of the essential form of education; (2) a discussion of discuss-worthy traits of NVAS (2014); (3) areas worthy of consideration for improvement; and (4) a concluding critique.

The Essential Form of Education

Can we easily reach the conclusion that study is the process moving from simple to complex? Is the form of study linear climbing? Planar expansion? Or three-dimensional and even 4D dynamic transformation? I should like to propose the model of "study" as spins with branches: several core competencies (NVSA set them as Connecting, Creating, Presenting and Responding) expanding in certain directions each, with every branch subdividing into more specific minor abilities, and the function of education here is to leading branches to occupy potential blanks. In this non-stop process, multiple core competencies would overlap and intersect with each other, consequently broadening the territory of competencies.

Some Traits of NVAS (2014)

Firstly, coherence can be seen in: Creating, Responding, Connecting and Presenting which involve relationships, tying the whole process of art and the participants together. Coherent but

not repetitive, each category focuses on specific developmental index, such as responding emphasizes how to decently interpret others' intention while presenting requires creators to take preconceived audience's reaction into consideration. The sequential arrangements of standards are based on dissociation of a professional art critique: emotional and rational inspiration, investigation, experiment and meaning-making. Therefore, the PreK level of standards are mainly focused on finding one's emotional and aesthetic responses to the world around. The external conditions for this period would be from Grade 1 to Grade 5, students are expected to explore the external world and react to relevant issues consistent with a structure. What is worth mentioning is that the grade sequence did not play an important role here—the standards are applicable in different age groups, but are not specifically aiming at stage-based development.

Compared with mastery in a particular skill, NAVS lay particular emphasis on proficiency of artistic intelligence or the command of artistic literacy. Also, no specific material or media is mentioned—as I indicated in the introduction to the NAVS, the standard makers hoped these would be more inclusive and applicable in more areas, which also, of course, depends on regional economic or cultural conditions. In contrast, the language of art or artistic literacy/vocabulary is nearly at zero cost. It is also evident that terms of art also formulate an essential atmosphere. From this aspect, NAVS appear to be advisable rather than regulatory. The results could be observed and recorded, but it would be hard, in my view, for teachers to provide quantitatively unified reports.

Some Areas for Consideration for Possible Improvement

As has been discussed previously, we can hardly find corresponding standards on cognitive development. The visual arts standards developers definitely had taken into account the ages of learners but more probably, in my view have considered study as a straightforward linear movement from simple to complex. However, according to Piaget (1969), children are not less smart than adults—they think in different ways and with different capacities.

Yes, for here I would quote my adviosr, Professor Sproll's note here:

"Zheng, it is important for you to understand that the standards provide a broad framework for teaching & learning. It is not a curriculum, so it will be up to teachers to bring the level of specificity for instance in regard to which materials might be best to use. The standards provide teachers with a guide then it is up to each one of hem to develop the curriculum."

For example, NVAS (2014) suggests in the PreK stage, children should get the opportunity to experience various materials, and OSVAS also includes the use of electronic technology in art education in K-1-2. It is true the frameworks do not aim to give specific instructions of what materials and media should be included. Crayons are more controllable than watercolor for young children (Lowenfeld, 1952), and some electronic devices might harm young children' sight. In present society, everyone is busy dealing with all kinds of materials, and this urgency and anxiety pushed educators to pile media up in front of children. One principle should be set here is to not introduce media that could bring irredeemable effects on students. I would argue that being over developed is as bad as being not developed enough. A trend could be inferred from the change of OSMAS—media art endangers the state of traditional visual arts. We are in a brand-new era, which is formulated by distinctly different media than before. Also, the function of new media is more visible than traditional forms.

Another point was that teachers can hardly provide quantitative

evaluations of students' artistic development. Is mathematics more helpful in one's development than art?—scientists cannot provide absolute conclusions. It can be justifiably argued that many people would not use math after they graduate from high school, however they will encounter art every day. So, why? Partly, because math gives accurate measurements and clear rights and wrongs—not getting the right answer suggests the student is less developed. Moreover, correcting the answer could immediately give positive feedback—indicating that this person is closer to societal expectations. However, art does not provide such a sense of absolute security, since art emphasizes one's difference among others. Is that so?

My Statement: Art could also be quantitively evaluated.

I believe visual art could also be examined according to unified rubrics—I know this may sound ridiculous. It's something that everyone can do but not everyone can do to the same degree. For instance, just like jumping, everyone can jump, but each person has a different representation of muscle control, explosive power, time in the air, height and so on. Those indexes all indicate a persons' physical conditions. For instance, proficiency in painting can perceive space, grasp of key points, capture of color, control of overall relationship, enduring attention and patience etc. All these are not, in my view, less important than composing an essay. Also, the perception of depth and dimension is also a basic ability required in mathematics—to express proper relationship of dimension is no easier than to solve a geometric problem.

It is important here to acknowledge I am not arguing that art is useful because it could be used as a measurement tool for other subjects, though indeed it can. For Art for art's sake—art

subject has its own purposes. Not having developed a scientific evaluation for art is because art practitioners have not clearly found the value of arts—so it is no wonder the public ignores the importance of arts. As art educators, we need to distinctively demonstrate the corresponding cognitive abilities developed by art subjects—these are more convincing than jargons.

Media Arts Versus Visual Arts

In China, we usually use "美术", which is similar to the combination of "Art" + "Craft". And the updated name for "craft" is "Design". For example, my academy was named "Art & Design Academy". "Media Art" only exists in two courses of the whole compulsory curriculum. It is quite new for me to see the division of "media arts" and "visual arts." In my own experience, though instructors strongly emphasized the importance of acquiring new media—we are still reluctant to learn processing or some very technical methods. We thought that went beyond the range of "art." However, undeniably, new media is necessary.

In NAS (2014), visual arts refer to traditional art or fine arts, and media arts contain the most range of design and perfor-mative/ contemporary art. This is quite interesting: one the one hand NAS (2014) broadened the range of art, but on the other hand, it isolated and marginalized fine arts. Media arts endangered visual arts in the sense of individual subjects. This division definitely stresses frontline art teachers—to learn a quite new subject or wait to be obsolete?

Also, one essential point proposed by my friend Em was that traditional visual arts require a large amount of training to

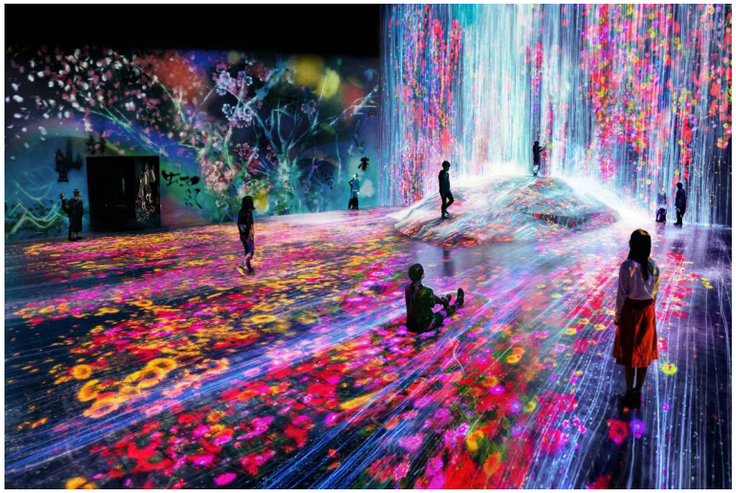

Figure.23 Artwork of Teamlab

reach mastery of certain skills while the media ones do not. That is true, for example students need to learn how to mount the canvas, blend pigments, and observe when to apply a new layer of color on the former layer. However, regarding media arts, "new media" seems to be something readymade and without any prerequisites. Materials could be gathered from the market and then be generated by certain automatic procedures. The dominant state of artistry or the interaction between material and artists was drastically abridged. And one of the most pivotal functions of arts is to improve students' sensitivity toward the subtly changing world through delicate training. And during this process, students began to build connections with the outer world in their consciousness extended by art.

So the question is can media arts substitute visual arts one day? In the past, the significance of art was discussed in the definition of "fine arts," so seemingly it cannot be replaced easily. But the division in NAS (2014) and the update of OSAS (2021) absolutely informed me there will be a trend. In my view, I regard visual arts as the basis of media arts. The aesthetics, ethics and philosophy were formulated in art history. Historically, the shift

of media is also the development of art. The separation of media art and visual arts is in my view and that of many of my colleagues an arbitrary and unnecessary distinction. Not only because the categories are not clear due to many forms overlapping with each other, but also the educational targets of media art remain vague

I agree with RISD Professor Sproll's opinion that there should be a highly synthetic notion of art, design, media and critique. I have to admit that did not think much about this until I typed these words down—how harmonious to place them together—they are different descriptions of the same thing in various angles. However, I still optimistically assume that the division of media art and visual arts is an internal issue inside the art range—it may combine drama, music, performance but basically it is something needed to be accomplished in the structure of fine arts or visual arts. And if the separation is an irreversible trend, visual art educators should positively move on to conquer leadership in it, or visual arts might truly be expelled from the center to the margin of "Arts".

A Concluding Critique

In my analysis of the National Visual Arts Standards and the National Media Arts Standards (2014), I have come to feel that these standards were constructed in a deconstructive and retrodictive approach. The high-school-level standards seem adequate to include the requirements necessary for an emerging professional artist. Maybe the reason for this generalization is that the highest level in K-12 education is high school. To reflect

their abilities and horizons, the standards authors present all they know. Finally, these standards in my view are established from the perspective of what contribution a person can make to the society, rather than the discovery of a person himself or his own knowledge. I say this because I believe discovering oneself is the value uniquely offered by art and by no other school subject.

Figure.24 Traditional Fine Art

Interviews of Practicing Art Teachers

In order to understand the impact of standards on everyday teaching and learning, I thought it important to gather insights from practicing K-12 teachers. I therefore developed a series of interview questions for art teachers that focused on curriculum setting and student development in order to assess to what extent teachers believed whether standards at each stage either accelerated or hindered students' cognitive abilities. Thanks to Tisha (teaching K through 8), Benjamin (teaching in elementary school), Kari (teaching in middle school), and Tiffany (teaching middle-high school also senior high school), some observed phenomena in their teaching practice could be reported

In the first part of the curriculum setting, four questions were asked:
(1) what art-making techniques are taught?
(2) what materials are introduced?
(3) What time would teachers arrange art classes?
(4) what standards did teachers use to evaluate students' artworks?

The first two aspects are closely related, and all interviewees answered the separated questions simultaneously. This reminded me of my ignorance of the connection between form and content. Benjamin and Tisha both created their own curriculums and introduced as many art-making techniques as they could, ranging from 2D to 3D. Benjamin specifically mentioned that in 1st and 2nd grade, he focused on bringing students to get

into contact with all kinds of materials, while after 2nd grade, the point moved to fewer techniques and greater mastery. Technology was introduced in 3rd grade. Tisha also teaches contemporary arts and native history within their unique expressive methods, for example, crochet as native crafting. The curriculum Kari showed me for middle school comparatively emphasized the more exquisite notions of art, like composition (color, shape, line), space, perspective, and etc. Each concept was introduced into class with a theme so students could learn color and composition via negative and positive space. As in senior high school, the curriculum Tiffany shared with me indicated that students in this stage are expected to master their art-making skills and develop their own expressive methods in the longer process.

A trend of moving from **breadth toward depth** could be seen here.

In elementary school, art classes are compulsory; while in high school, art is only an elective. When children are younger, the duration or an art project will be shorter because children's attention cannot last long. As they get older, the duration could be expanded since they can recall what happened last class. However, the arrangements of art classes are usually decided by schools, in which teachers can hardly decide how long an art project will be as they want. If students could engage in community art, they can polish their ideas in long-term projects, Kari indicated that "more thought out and a more finished look".

Kari and Tiffany used the Ohio Visual Arts Standards as benchmarks against which to evaluate students' artworks. Ben said he would partly base his evaluation on the state standards but cared more about the progress that students made throughout the whole process — since he believed every student has a different

baseline and he always hopes to aid students to reach their own targets. Tisha developed her own teaching philosophy, as she said she was "glad that school gave freedom to teachers to develop their own teaching modes". The evaluation standards Tisha used are not product-oriented but process-oriented: if students positively engaged in the assignment took the responsibility to clean the classroom together, and respected others, they could get As.

A trend of "**Children-Centered → Standardization**" appeared here, maybe partly because students who study art now are preparing for college level art study.

The second part about student development includes 3 questions:
(1) As students get older, do they show the growth of cognitive abilities?
(2) Are there differences in learning abilities among genders?
(3) Do students' developing speeds differ or at the same pace?

Tisha suggested the main development was evident in the longer attention spans and refined skills. Kari said that 6th grade children tend to be more active and vocal, i.e., more energetic. While 8th grade students prefer to sit still and more silent about questions. Tiffany used the word "maturity level" to describe the development she discovered, "it's like the natural progression of growing up". When students are younger, they are more likely to explore; as they get older, they are inclined to be more serious and focused.

Ben and Kari said they did not think there were real differences in learning abilities among genders. What is worth mentioning is that Ben tried to eliminate the stereotypes of gender in art,

like "pink was regarded as a girlish color", by introducing the history or the application in arts. It is very interesting that Tisha confirmed my speculation that girls do better in color painting while boys do better in 3D building. She also said it is maybe because art is compulsory in elementary school while only elective in high school. Thus, senior students were selected and collected by their choice, which is based on a similar tendency.

As for the developing speed, Tisha said "I would say that there are definitely girls who tend to have better fine motor control at a younger age, and then it starts to balance out." Generally speaking, girls tend to be more focused and drawing in a neater way, while boys usually are more active and pay less attention to adding details or trying to refine their drafts. Ben observed that 10–20% of the class move ahead, 10–20% move behind, and the rest are about average. Kari, in middle school raised the statistics a bit, 25% ahead, 25% behind and half on average. The opinion Tiffany brought up is really thought-provoking: till the stage in high school, the ability gap of students is no longer dominated by school education while it depends on family support and extracurricular training to a great extent. Talent also plays an important role, which is an undeniable fact.

A trend of "**Chaotic balance → differentiation**" appears here.

In summary, Ben, Tisha, Kari, and Tiffany offered much more help than I could have ever had expected and I was truly astonished by how advanced their teaching approaches are (compared with my own experience). I had hoped to develop a curriculum with specific targets in each stage that best fit and can accelerate students' development. However, Ben taught me an important lesson that sometimes moving beyond the

supposed limit is also beneficial as he shared "just because a student doesn't fully understand something, doesn't mean it is not a worthwhile experience". And this was also supported by the different developing speed—we need to provide more diverse and customized teaching to suit different students' abilities. The teacher sows the seed, and the seed waits for the right opportunity to germinate, maybe at different times.

Discussion

Even though the academic field has conducted considerable research about cognitive development, its effect on visual arts learning is not fully understood. Also, I would argue that consensus about developmental stages has not been reached. My investigation has led me to believe that schools may be well advised to refine and deepen curricula so that they can more fully support student learning. However, teachers will inevitably find that students are so diverse that not many similarities could be discovered. Children-centered or child-centered? To be practical, I contend the most promising way teachers can achieve this is through the introduction of multiple methods and materials, as approached in this manner students would not feel left behind and would get the chance to build confidence during various processes. Some usage of material may go

beyond students' cognitive development; however, I would argue a lesson will not harm a student's ability in any observable way. I strongly believe the benefits overwhelms harm, if the latter exists at all. It is worth mentioning that a short period of experience is very different from long-term education, and that is what curricula setters should be cautious of.

Figure.25 K-12 Art Education

Implications for Educators and Policy Makers

It is a peculiarity of American situation that National Visual Arts Standards are not compulsorily enforced nationwide, they are merely of suggestive and instructive function. Socioeconomic developments and culture vary among states and it is school districts that have ultimate regulatory power over what is taught in their schools. To respect different backgrounds, the essential guideline for art education is to act according to specific circumstances. One school district may have its own art education curriculum that more or less borrows from the framework of the National Visual Arts Standards. It is my belief that if policymakers and educators could both adjust their strategies in various ways, art will contribute to students' global development, not only in art subject but also facilitate academic performance, interpersonal relationships, social bonds and life attitudes. Previous art education piloting tests has paved the road and proved to be helpful, and we need to digest and move forward.. In this final chapter of my thesis I will share some personal thoughts and advice that might be useful for policymakers and educators.

For policymakers, I argue that there are three factors that should be considered when formulating curriculum guidelines pK-12 visual arts education. They are, firstly the degree of execution, which refers to how educational standards work in reality; secondly, a student-oriented system; and finally, the main powers that lead to social changes. First of all, given full respect to different social ideologies, the following discussion attempts as best possible not to involve personal value judgement. However, it is undeniable that not fully applying well-designed

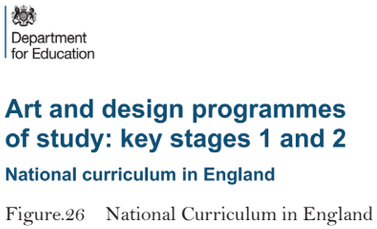

Figure.26 National Curriculum in England

visual art standards is somewhat a waste of eminent educators' wisdom. The United Kingdom constructed a set of art subject guidelines that are utilized around the country, which can ensure every student to get access to art education that is attached to the same importance. I deeply admire the National Visual Arts Standards and think those standards should be widely put in use rather than stay in what appears to me to be an awkward "suggesting" status. Even though situations differ in regions, the basic structure should, in my view be consistently adopted across the nation.

Secondly, compared with circumstance-based education, I strongly believe that the construction of a competency-based instructional system is needed. Competency here means students' current and potential abilities. The developmental stages here are of concept, used to distinguish different features of studying stages rather than indicating real sections. Human development is not intermittent dots but continuous phases. Thus, it is always necessary to break the comfort zone as Vygotsky termed "the zone of proximal development" (Blanck, 1990, p. 46, cited by Efland, 2002). Art education should provide a system that contains dynamic approaches to instruction that both encourages and challenges students, and s supports educators to best facilitate student's potential. Moreover, adopting abundant teaching materials in specific stages is highly significant, because synaptic connections are built at the highest speed only in early stages. Advanced educational mode should best facilitate students' potential with adequate and appropriate challenges and teachers' guidance.

Last but not least, education aims to nurture proper citizenship and provide people with living skills. And to achieve these goals, it is always necessary to consider what are the main instigators that lead to social change. Currently, science and technology are the catalysts for social progress, taking the place that used to be held by philosophy. Art, I would argue, could be considered to some extent as the visual representation of philosophy. Philosophy also lies in the core of art, however presently the uproar is about integrating art with science. I view science as an internal observation tool, rather than the observation itself. Innovation and discovery of sciences may provide many upgraded clues to redefine what art educators take for granted. Besides, the value of the technology is the thought process behind it, rather than the final form. Thus, integrating new technologies into the curriculum is what educators should begin with. The National Visual Arts Standards (2014) separate media art and the visual arts, though many progressive educators are reluctant to make this distinction. However, again in my view it is urgent that traditional visual arts education should not lose leadership in the new era and always internalize so called "new" media to ensure its vitality.

In summary, building a dynamic competency-based system, responding to factors leads to social changes and making sure guidelines could be put into use should help. For educators, my thoughts are around the new challenge for present art teachers, new responsibility and the urgent need for constructing an updated assessment system. As has been discussed in Chapter 4, the division of media art and visual arts suggests a more dangerous status than art teachers could imagine. Educators need to update the inclusion of media—it is not about whether art educators should teach a new subject, it is about

defending their positions off the encroaching territory. Yet, high-technology only exists in confidential labs, and accessible media are just abundant in our daily life, frontline educators may not need to be much too anxious about that. We can start by letting students discover new meanings of daily media. In short, art educators have to update themselves as they transfer teaching strategies acquired from traditional media into "new" media.

Who though is to be held responsible for promoting art education's status? First of all, of course it is art educators. Arts' value is implicit rather than explicit, therefore collabo-rative meaning-making procedures are vital to engaging a larger audience. The National Visual Arts Standards (2014) is an excellent exemplar for educators to find what art carries. Creating, Responding, Presenting and Connecting fosters a relationship between students and the outside world. Teachers should include more critique processes in curricula and hold more educational exhibitions. During this collaborative process, families, school staff and community members are able to participate in what can be viewed as a connected field. When students share their thoughts during critique or final representation, meaning resides not only in making, but through presenting it is also shared and enhanced. I firmly believe that meaning-sharing should be the critical conclusion of art making. Displaying how art connects people and the world in such a broadened view will be a much more convincing and compelling way of proving art's value, and this can only be achieved by art educators.

Figure.27 Community-based Art Project

This is also a way of understanding art history.

Finally, I believe that straightforward learning outcomes speak louder than any hypotheses. I argue, though this may sound absurd, that there are as many quantitative indexes that demonstrate students' development in art as there are in STEM subjects. For example, a painting of a living flower contains a massive amount of information (data) such as size and proportion, which demonstrates the painter's confidence and aesthetic intuition. The accuracy of shape indicates the development of eye-hand-brain harmony. The gradations of details show the student's ability to organize elements and the logic of sequence. The colors display mental status and sensitivity. The width and smoothness of lines are symbols of muscle control and self-assuredness. The overlapping relationships represent the sense of 3D space and etc. More interpretation could be borrowed from clinical psychology and cognitive sciences if art educators want to. I urge art educators to stop deceiving themselves in their belief that art doesn't have a set of unified standards—that is not true, or how do top art schools select students and have such low admission rates? Art educators, please move forward and explore the scientific roots for tacit jargons in this field. Only standards that withstand the inspection of other academic fields could establish its legitimacy. With the united endeavors of policymakers and art educators, such a dynamic system could be built for instance, art educators should take responsibility for embracing new possibilities, connect students with the wider society, and present convincing answers to questions about what art can do. It is imperative that art educators in instructional design incorporate content and strategies that will lead to social change but in doing so always care for students. It is my view that only doing what I discuss here that we can justifiably assert that we tried our best to improve art education.

Figure.28
Still Life with Flowers by Ambrosius Bosschaert (1617)

Figure.29
Flowers in a Glass Vase, with a Cricket in a Niche by Rachel Ruysch (1700)

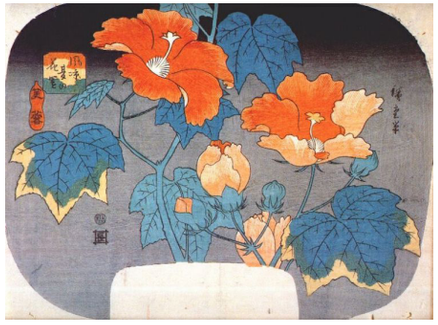

Figure.30
Hibiscus by Hiroshige (c. 1845)

Figure.31
Bouquet of flowers by Edouard Manet (1882)

Figure.32
Roses and Lilies by Henri Fantin-Latour (1888)

Figure.33
Still Life with Irises by Vincent Van Gogh (1890)

Figure.34
Flower Garden by Gustav Klimt (1905)

Figure.35
Water Lilies by Claude Monet (1908)

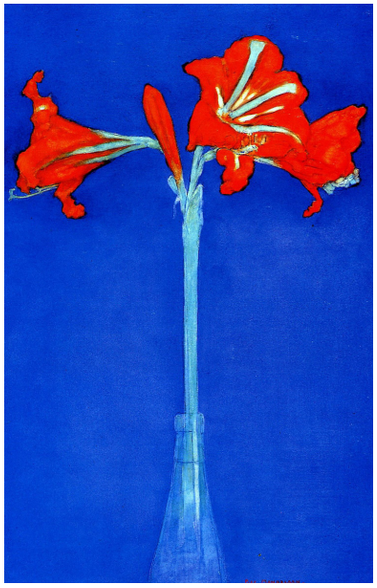

Figure.36
Amaryllis by Piet Mondrian (1910)

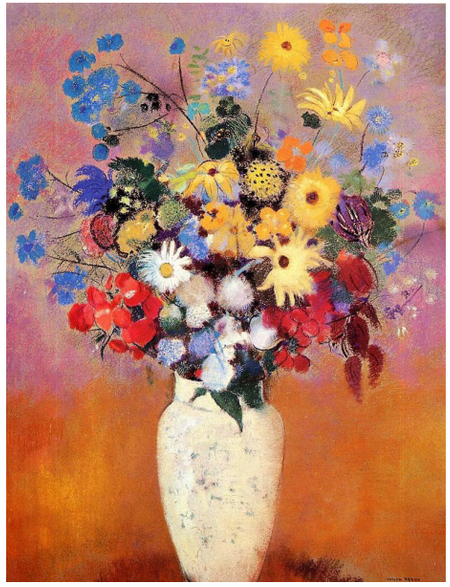

Figure.37
White Vase with Flowers by Odilon Redon (1916)

Possible Transfers to Different Cultural Contexts

Before any objective analysis, I need to express how astonished I was when discovering that what students learn in American elementary schools is what I have not experienced in my Chinese university-level study. I found: (1) the gaps between American and Chinese art education; (2) American curriculum settings and student development; (3) and new art educational approaches for China.

The Gap

The first gap lies in the faculties. The premier art schools in the United States have Master of Arts in Art & Design Education and Master of Arts in Teaching programs in art education, and their alumni particularly from MAT programs will teach in K-12 public and private schools or in other settings after graduation. While in China, art students are generally considered as having lower academic performance. Further, the majority of Chinese students would not choose Normal College (teacher preparation) if they had access to a better option—regrettably worse are those who study art education. So, I was astonished that an alumnus of RISD, a top art school in the US, would be willing to work in a more local position with less impact. The discouragement of top students to work in local positions impedes Chinese art education greatly: on one hand, art teachers do not get enough respect and thus they lose passion in teaching practices; on the other hand, less able students would consider to occupy this vocation. Also, another speculation emerged: does it mean even getting admitted to the best universities cannot change one's destiny in the US? Or is it a natural phenomenon of developed society, that nearly any position could afford people enough financial support and dignity.

Another gap is the curriculum setting. All my four interviewees showed me abundant resources in their curricula. Tisha and Ben introduced all kinds of materials, techniques and styles to students in their elementary schools, especially basic mechanical engineering and technical software like Photoshop in 3rd grade. Even in the so-called best university in China, professors never include technical utilization into curricula. American teaching resources are undeniably much richer than those in China.

Context and reality factors

There are of course political, socio-economic problems that need to be solved in China, comparatively education is not urgent—however, I believe it will be urgent soon. The negative effects of neglecting cultural contributions to society is increasingly obvious—people's values are distorted and lack the pursuit of higher spirit. In China the current criteria for Art are based on western values. China's art education once duplicated the Soviet Union's mode. For instance, the department setting and curricula of the Central Academy of Fine Arts are basically the same as the Repin Academy of Fine Arts. However, it is true that such educational orientation fluctuates with international relationships. Under the influence of the Cold War, western educational mode would not be accepted, at the same time our relationship with Soviet Union deteriorated. As we struggled to develop in our own way, traditional arts were included into institutional settings of Art schools. I would argue that we have not yet found our own way. To sum up, we art educators need to recognize the real power of art in leading social changes, and more importantly we need to persuade the public—students, parents, schools, policymakers and society.

New art educational approaches for China

Content

I found it very interesting that Tisha taught young students Expressionism. Why this is pivotal is that Expressionism is the domestic art style of the US! I think more traditional or domestic forms of Chinese arts should be included in the curriculum. For example, we can teach students to study traditional freehand brushwork:

Figure.38
Traditional Chinese Expressional Brush Painting

It is more of abstract and occasional brushwork, and it is of low difficultyl. We can also ask students to practice from the monochrome of a single flower to more complex figures such as portraits or landscapes. In this way students will get acquainted with traditional media and thus learn the inherited relationship with materials as our ancestors did. China's own aesthetics are what we really need. Also, new techniques should be included

in the curriculum. Education should provide students with better control of the present world, and new generations will be connected with technology much more closely than us. Schools can barely afford Adobe software, but there are many available approaches. Photo essays and video stories will work fine (no need to purchase expensive cameras, cell-phones will be fine). Integrating real-life content into art teaching will also be a possible way. For example, art teachers can at least teach students how to decorate their essays or mathematical notebooks. Moreover, art education will definitely contribute to school-wide activities.

Practice

Calligraphy has been added into Compulsory Education (1st grade to 9th grade) in China. However, I think it is just pure formalism—nowadays, we only type and submit digital documents. Who will write with brushes and wait a long time for the ink to dry on the paper? But thanks to this policy, schools are required to support art. Schools need to provide enough art classrooms and give students enough space to store their materials. Also, 45 minutes for one art lesson is never enough, two lessons together will be fine. Teachers also need to be trained every several years (about five years). I just could not stand my previous teachers who kept reading from the same slide shows they created the day they were hired. If teachers are not making any progress themselves, how can students adapt to the changing society? If schools would increase the amount of time designated for art, physical education, and music classes, I believe students' burden will be less and they can live in a much healthier way.

Figure.39
Child learning Chinese Calligraphy

Possible policy guidance

I am not advocating that an Art examination should be compulsory for entrance exams as not every family can afford the tuition. Forcing families to support art study is neither practical or meaningful. And it is true that many majors other than art, especially those pursuing STEM disciplines, could have a greater economic impact. However, art is not only of utilitarian purpose. Maybe some policy indicating the minimum standard of art classes, or the schools' administrators will be punished. But this solution is just superficial rather than radical.

Moreover, from an international perspective, our culture has been invaded by Hollywood, Netflix, Japanese animation, and Kpop heavily. I am not advocating for blocking global information, but we need to pay more attention to the effects of pervasive western values. Now, young generations hyperfixate on international cultural symbols rather than home role models and they potentially can lose confidence in our own culture. Also, the outer world would also misunderstand us if we lose our voice—we need to announce our existence peacefully and softly via art and make us heard to the outside. We should not merely blame Western media for distorting the truth. It is time to reflect on our absence in international discourse. Military

force may be threatening; economic growth may be competitive; only culture, not ideology, especially arts can be recognized around the world. Arts move beyond language, sharing the most common cognitive elements.

Envisioning the Future

With knowledge of theories of art, cognitive science and National Visual Arts Standards (2014), I have gained a general understanding of the curricular guidelines for American art education. Yet, I fully acknowledge I have merely touched the surface of this deep ocean. I sincerely hope to get an opportunity sometime later to carry out further investigations. There are still remaining fields that are as yet mysterious to me

Firstly, how does a brain develop? Are there any humanmade interventions available to facilitate one's growth? As the young cognitive sciences become a bit mature later, could new findings indicate the way for educators to accelerate mankind's development? Nowadays, the speed of acquiring knowledge is much slower than that of senility.

Secondly, what is Art used for on earth? How can art indeed help reach the border of the known and the unknown, and thus aid one's cognitive development? Art scholars have continuously endeavored to appeal for the public's attention and tried to prove art's value. Could one day science give concrete discoveries that support the meaning of Art?

Thirdly, is it a question art for art's sake or integrated discipline? Upcoming media keeps challenging the traditional range of visual arts — will the visual arts be broader or narrower? Technology is what we can hardly circumvent in this generation. The few ways to maintain art's state or even enlarge its territory would be to embrace new possibilities ahead of other disciplines. Definitely, that is the openness and connectivity we always emphasized as the basic characteristics of Art. Art educators, please no longer stay in the comfort zone of defending art as important as other subjects — we should step out and integrate other subjects inside art in an offensive manner! Art in activism!

Finally, I always argue for a quantitative approach to assess artwork. It is hard but I believe is well worth researching — why in the context of schooling is a painting considered less important than a 500-word essay? Why would a physics test paper testify a student's intelligence better than an art installation? Art integrates knowledge acquired from other subjects into social or living sceneries and it is the best way to observe student's understanding of what they have learned. A set of assessments could potently approve actual educational progress. And it is my hope that I could gain answers to the questions I pose that have emerged as a result of this MA thesis here in my later PhD career.

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relationship,
suitability,
and future implications

Zheng YAO