Designing for Children
- With focus on 'Play + Learn'

Interventions in Cognitive Education: Kid Architecture

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Abstract: The kid architecture program was started some twenty-two years ago to introduce young people to the design of the built environment composed of one-week camps structured for three different learning levels, grade, middle and high school. The initial goal was to provide an opportunity for young people be introduced to the design of the built environment in particular design problem solving. The foundations are built upon the ideas of Rousseau, Pestalozzi, Froebel, and Gardner. Evidenced-based research is presented purporting the sigificance and effectiveness of the camps.

Key words: Constructivism, Design Pedagogy, Cognitive Interventions, Problem-based Learning, Situated learning, Situated Cognition, Cognitive Apprenticeship

Introduction

The kid architecture program was developed twenty-two years ago to introduce young people to the design of the built environment. The one-week camps are structured for three different learning levels, grades 4^{th}-6^{th}, middle school and high school have been conducted in various locations nationwide to include the Smithsonian and The National Building Museum Washington D.C. The camps have worked with inter-city (at Risk) children, disabled those with learning disabilities, and autistic. The camps have received national and regional awards for the broad breath of hands-on activities and implementation of technology. The ten objectives that the kid architecture camps strive to endeavor are to develop an understanding of the following:

- Why buildings look the way they do

- Why building stand up
- What architects and designers do
- Design drawing as a problem solving tool/method
- The use of the design process as employed by architects
- How a building is designed, constructed, used and reused
- Construction materials used in buildings
- How and why people "define" space
- The use of computer graphics, animation and CAD
- Participation in the design of the built environment

The philosophic foundation that kid architecture is built upon is the assumption that those who are exposed early to architectural design will have a different conceptual base from which to formulate more complex and differential ideas about the built environment. Architecture Camps' personnel believe this cognitive skill is as basic to a young person in the modern world as knowing left from right or discriminating the letters "b" from "d". People who are deeply aware of the built environment will make future advances in the conceptualization of buildings, cities, and personal living spaces.

Kid Architecture has been awarded the following; An Award of Merit from the American Architectural Foundation (twice), Citation of Honor from American Institute of Architects Illinois, The Presidential Award from the Southern Illinois Chapter of the American Institute of Architects, An Honorary Membership to the Association of Licensed Architects, a Connection Citation from the Illinois Board of Education, an Award of Distinction from the Urban Network, Chapter Educational Award from the Construction Specification Institute, and a Region Educational Award from the Construction Specification Institute.

Our research is based upon the theory that learning and knowledge are inherently situated in physical and social contexts. "Situations might be said to co-produce knowledge through activity. Learning and cognition, it is now possible to argue, are fundamentally situated" (Brown et al, p.32). Situated learning is defined by Collins (1998) as "the notion of learning knowledge and skills in contexts that reflect the way the knowledge will be useful in real life" (p.2). It is maintained that cognition is not confined to the individual but is connected and coded to the environment and activity in which it was developed (Brown, Collins & Duguid, 1989). Therefore situated cognition theory encourages educators to teach in contexts to the 'real life' environment of the subject (Schell & Black, 1997; Brown, Collins & Duguid, 1996; Lave & Wenger, 1991; Vygotsky, 1978). Paula Vincini (2003) arguing in favor of 'situated cognition' states that; "* Learning

is driven and best presented through realistic and complex problems that allow learners to learn to think and practice like experts in the field.

"Piagetian theory suggest that students' cognitive systems are important to consider because they influence the ability both to work cooperatively in teams and to understand the curriculum content. …Task-relevant peer engagement characterized by questioning, explanations, and predictions leads to perturbations that in turn lead to modifications of cognitive systems" (O'Donnell, 1999, p.36-37).

Problem-based learning is a practically oriented pedagogical model, in which students develop their expertise on the content area under study by working with cases and problems that represent real life situations (authentic problems) (Savin-Baden, 2000). Barrows & Tamblyn (1980), the pioneers and developers of the model, define problem-based learning: "…the learning that results from the process of working towards the understanding or resolution of a problem. The problem is first encountered in the learning process, and it serves as a focus or stimulus for the application of problem-solving or reasoning skills, as well as for the search for or study of information or knowledge needed to understand the mechanisms responsible for the problem and how it might be resolved.

The outcomes of problem-based learning are anticipated to be: 1) the increasing expertise in the content area; 2) problem solving skills and the ability to solve new and challenging problems; 3) good metacognitive skills, like an ability for self-reflection; 4) higher order cognitive skills, like decision making, critical and creative thinking; and 5) the ability to combine declarative and procedural knowledge.

Vygotsky (1978) postulated a 'Zone of Proximal Development' the added learning capacity of a student when supported in performance by an expert, teacher or more skilled peer. "The zone of proximal development is that "distance" between a child's unassisted capability and the child's capability to perform with support" (Wilson, Teslow, & Taylor, 1993). Vygotsky argued that instructional methods should emphasize the need for 'expert guidance' and social interaction (Vygotsky, 1978; Newman, Griffin, & Cole, 1989). Vygotsky theorized a condition whereby students, working in a group, solve challenging problems, with support from competent instructors; thereby individual students internalize the methods and goals of expert problem solvers. The zone of proximal development is coherent with cognitive conceptions of motivation.

The foundations kid architecture are Jean-Jacques Rousseau's, *Émile, or On Education* was considered by to be the "best and most important of all my writings". It tackles fundamental political and philosophical questions about the relationship between the individual and society— how, in particular, the individual might retain what Rousseau saw as innate human goodness while remaining part of a corrupting collectivity.

Following Rousseau in 1801 Pestalozzi gave an exposition of his ideas on education in the book *How Gertrude Teaches Her Children*. His method is to proceed from the easier to the more difficult. He once stated, "The role of the educator is to teach children, not subjects." Moving to Froebel in his classic of childhood education identified the fundamental principles upon which he based his now-ubiquitous kindergarten system. Froebel demonstrates how to channel child's play and integrate it into the development of intelligence and social skills, explaining the vital inner connection between the pupil's mind and the subject of study. Into the 21st century the work of Howard Gardner, his Multiple intelligences an idea that maintains there exist many different types of "intelligences" ascribed to human beings. In response to the question of whether or not measures of intelligence are scientific, Gardner suggests that each individual manifests varying levels of different intelligences, and thus each person has refined in subsequent years. In 1999 Gardner lists eight intelligences as linguistic, logic-mathematical, musical, spatial, bodily kinesthetic, naturalist, interpersonal and intrapersonal.

Learning better by doing instead of book-oriented teaching is not novel; it is being practiced across the country in many middle and high schools today, including: Salvadori Center in New York; Design and Architecture Senior High School (DASH) in Miami; Charter High School for Architecture and Design (CHAD) in Philadelphia; the Prairie Village, Kansas-based center for Understanding the Built Environment (CUBE); the Center for Urban Pedagogy (CUP) in New York; the Chicago Architecture Foundation's education program; and the New York City's Cooper-Hewitt museum summer design institute for educators. What is novel about this research is not the new integrated curriculum but the ability to use the intervention to produce empirical evidence that will either prove or disprove the hypotheses.

The Kid Architecture integrated curriculum will help improve middle schools remedial and minority students' cognitive skills, knowledge and achievement test scores. It is an instructional method that appeals to the visional learners and motivates the remedial. The contribution of this program is that it may prove to be the alternate method of instruction that many students require.

Conclusions

It was hypothesize that the Kid Architecture Curriculum will demonstrate the following:

1. Will significantly improve middle school students' academic achievement in mathematics over traditional classroom-based teaching.
2. Will significantly improve low-income and minority students' academic achievement in mathematics over traditional classroom-based teaching.

3. And will significantly reduce the academic achievement gap between white and minority students over traditional classroom-based teaching.

Design used to collect Information

The design used to collect the data for the Kid Architecture Program was a pretest/posttest structure. These were norm-referenced tests that were useful in describing time-series designs for examining changes across time and to explore the causes for problems and identify needs, see Fitzpatrick, Sanders and Worten (2004). There was also a qualitative questionnaire that was mailed to the parents after the workshop.

Source of Information

The population of the camp was composed of randomly selected middle school students. Students were again randomly selected to be in either the comparison group or the experimental group. At program completion the experimental group retained twenty-nine (29) students, comparison group retained twenty-two (22) students; both groups completed pretest and posttests. The experimental group was composed of twenty-three (23) males and six (6) females, including nine (9) non-white students; 31% non-white and 21% female. The comparison group was made up of twelve (12) males and ten (10) females, including two (2) non-white students; 9% non-white students and 45% female. The comparison group was not exposed to problem-based learning or cognitive apprenticeship instructural methods.

Analysis Procedures

Results One: Percentages Correct by Total Group shows the experimental group out performing the comparison group in percent change/improvement in every category except design. The experimental group showed significant learning improvement over the comparison group in the following areas: history, geometry, environmental systems, and construction. The experimental groups' percentages of correct answers were also higher than the comparison group in: history, environmental systems, and construction.

Results Two: Percent Correct by Gender is similar to Table One in that both males and females of the experimental group out performed the males and females respectively of the comparison group in percentage of change/improvement. Experimental group males received higher percentage improvement in every category except design. And received the higher percentage of correct answers in every category except geometry. The experimental group females received the higher percentage of change/improvement over the comparison female in every category except history.

Results Three: Percent of Correct by Ethnicity tells us that the majority of Whites in the experimental group out performed the Whites in the comparison group on both number of correct answers and percent of change/improvement. And the majority of Non-

Whites in the experimental group out performed the majority of Non-Whites in the comparison group on both number of correct answers and percent of change/improvement. The percent of change/improvement and correct answers for the experimental group is higher than that of the comparison group. It appears that the intervention works to improve cognitive skills and knowledge of middle school students and is very successful with minority populations. This intervention will make a positive difference.

A post posttest was mailed to the experimental group to measure how much learning stays with the students over time. Approximately ten percentage of the students returned the post posttest. The number of student post posttest received is not significant; poor response is attributed to the time period from intervention to receiving posttest material. Students that did return the posttest answered questions in all five sections but were most successful in history, geometry, and design. Students were averaging between 66% to 86% correct answers in the geometry section.

Parents of the experimental group were surveyed to measure motivation, interest in school and learning. Approximately thirty percent of parents returned their survey. Ninety percent of the parents responded that their child liked the 'problem-based learning' style that was used. Seventy percent of the parents stated that their child's problem solving abilities increased. When asked if their child's math scores in school has improve: twenty percent of the parents answered 'no', forty percent answered 'yes', and the remaining forty percent answered 'no' that their child has 'always been good in math'. When asked if the architectural camp motivated their child, eighty percent of the parents answered 'yes'. "yes, he was excited each night and talked of all the thing he learned."

Reflection:

It has been some 52 years since **Ada Louise Huxable** commented, **"A lack of attention of both the press and public stems from a basic defect in our school curricula – neglect of visual education"** *New York Times Magazine 1958, maybe the education of children's design pedagogy is at hand.*

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