AN APPRAISAL OF GRAPHIC THINKING SKILLS IN NIGERIAN SCHOOLS OF ARCHITECTURE (A Case Study of the Department of Architecture, University of Jos, Nigeria)

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ABSTRACT

Graphic thinking refers to a process of thinking assisted by sketching. At the stage of concept formulation in the design process, this type of thinking is instrumental to developing the ideas in the design as thinking and sketching work closely to serve as a stimulus. There is a long-standing history between architecture and graphic thinking. From Renaissance times, most of the masters depicted their novel ideas and dynamic thinking in notebooks that revealed a lot about the process rather than the product of design. These were carried out in a variety of methods and scales including recent processes of graphic thinking though with the introduction of digital media of communication. This process is less manual and thus, far less observable. This study examines graphic thinking among design students in the University of Jos. It also aims at assessing the processes they adopt when designing. The study intends to highlight lapses in the process of design as illustrated in the graphic development adopted by students of design and puts forth four suggestions intended to encourage and enhance the incorporation of adequate graphic design development among such students. The quantitative analysis of the study draws conclusions from literary data and observations of students' design development through graphical means.

Key words: *concept, design process, development, design process, graphic thinking*

THE INTRODUCTION/BACKGROUND TO THE STUDY

Architecture is the art and science of organized enclosed physical space which is created to contain human activity as determined by their needs, wants, culture, traditions, experiences and life values. The said space is then meant to act as a filter between these activities and the external environment and be a reflection of practical planning decisions and creative ability and these in turn are supposed to determine people's reactions to the building and to each other within the building.

Analysts and psychologists alike have debated the attribution of creative design to purely rational, conscious thinking while others maintain it is a conglomeration of all aspects of the arts, sciences and the humanities. But many argue the interplay and fusion of the products of the sub-conscious mind play an even stronger part in creativity, where dream-like thinking results in the free flow of thought patterns. In many instances during this thought process, images may be captured and put down through means of graphic representation that allow the thinker follow the thought pattern and possibly determine the direction of the intended conclusion.

Throughout history, visual presentation - or more accurately, graphic presentation – has had an important impact on thinking. Drawings from historical accounts have always been used to depict and pre-dates the adoption of many written languages. Man has used signs and symbols; early written languages, as Egyptian hieroglyphics, were specialized sets of symbols derived from pictures (Laseau, 1980). In spite of the ascendency of written language, visual communication continues to be an essential part of the way we think. This is often evident in phrases such as "I see what you mean" or "take a look at the situation". Although research opinion varies, it seems generally accepted that 70 -80% of what we learn is through sight, especially in the world of design.

Visual communication continues to grow as a powerful influence in our lives: we rely heavily on graphics to explain and persuade. The emerging technology for collecting, storing and displaying different models of reality hold exciting promise. But computers cannot see or dream, nor can they create; computers are language-bound. Similarly, thinkers who cannot escape the structure of language, who are unaware that thinking can occur in ways having little to do with language,

are often utilizing only a small part of their brain that is indeed like a computer (Laseau, 1980). The new equipment is of no value in itself; it is only as good as our imagination can make it. If we are to realize the potential of visual technology, we must learn to *think visually*.

Here lies the key issue: are current and, more importantly, emerging designers translating their ideas graphically in the world of design? Are the skills required for the communication of ideas demonstrated adequately? What are the necessary skills for effective graphic communication especially in design and are such skills taught where they are not readily found in the communicator? There are many architects whose works we can turn to for inspiration to experience the resurgence of sketching. What starts as note-taking in a sketchbook or turning over design concepts in the design studio quickly become special things over and above solving the design problem. They become the "eureka" experience in the search for a solution.

This study aims at examining the graphic thinking process of design development in student architects as well as appraising the developments of renowned designers whose techniques give great insight into a process that is significant to a generation of creative architecture. The method of study is empirical and draws analysis and conclusions from data collected from responses to a questionnaire administered to students of architecture in the University of Jos, Nigeria, as well as students in other departments not involved in design which serve as a control group. The conclusions are also drawn from literary data on related fields.

THEORETICAL FRAMEWORK

WHAT IS GRAPHIC THINKING?

Graphic thinking refers to a process of thinking assisted by sketching. At the stage of concept formulation in the design process, this type of thinking is instrumental to developing the ideas in the design as thinking and sketching work closely to serve as a stimulus. There is a long-standing history between architecture and graphic thinking. From Renaissance times, most of the masters from that period depicted their novel ideas and dynamic thinking in notebooks that revealed a lot about the process rather than the product of design. The sketches suggest an element of thinking on more than one plane, dreaming and free-wheeling, abstraction, exploration and the consideration of many alternatives. This is also carried out in a variety of methods and scales.

Design is both a product and a process. Successful designing (as a process) involves knowing what to do and what not to do, how to learn and perform it by professionals and experts. Certainly all designers need to be creative. As designers, architects need a highly developed visual sense and usually need to be able to draw very well (Lawson, 2006).

Interest in graphic thinking increased somewhat during the era of Modern Architecture after the preliminary sketches of "masters" like Le Corbusier, Aalvar Aalto and Eero Saarinen surfaced later in their successful careers. Over time, those sketches became overlooked in favour of the renderings or photos of the finished work. Renewed interest in the sketching of 21st century architects of the likes of Santiago Calatrava, Robert Venturi and Eva Jiricna show, upon examination, what we might call "parallel lines of thought" (Lawson, 2006). These parallel investigations represent examinations into different aspects of the design. Thus, Eva Jiricna, who likes to work from materials, also has to plan her interiors in organizational terms (fig. 1). Similarly, Robert Venturi prefers to approach design not necessarily from "the general to the specific" but rather often does the "detailing at the beginning very much to inform" (fig. 2). The graphic presentation shows us how the design can suddenly appear but then need extensive refinement that is carried out with that of other ideas without attempting to resolve them too soon.

If we look further into these parallel lines of thought it seems that they often reflect quite conventional ways of thinking about the kind of design under investigation: Robert Venturi for his building as plan and elevation; for Eva Jiricna it's a collection of components and spatial organization. For Santiago Calatrava, his sketches provide clear evidence that he tackles design in many ways simultaneously (Lawson, 2006). In all these drawings, there are areas of vagueness as well as penetrating exploration. This indicates that good designers are able to sustain several 'conversations' with their drawings, each with slightly different terms of reference, without worrying that the whole does not yet make sense. This important ability shows a willingness to live with uncertainty, consider alternative and perhaps even conflicting notions, defer judgment, and yet eventually almost ruthlessly resolve and hang on to the central idea.

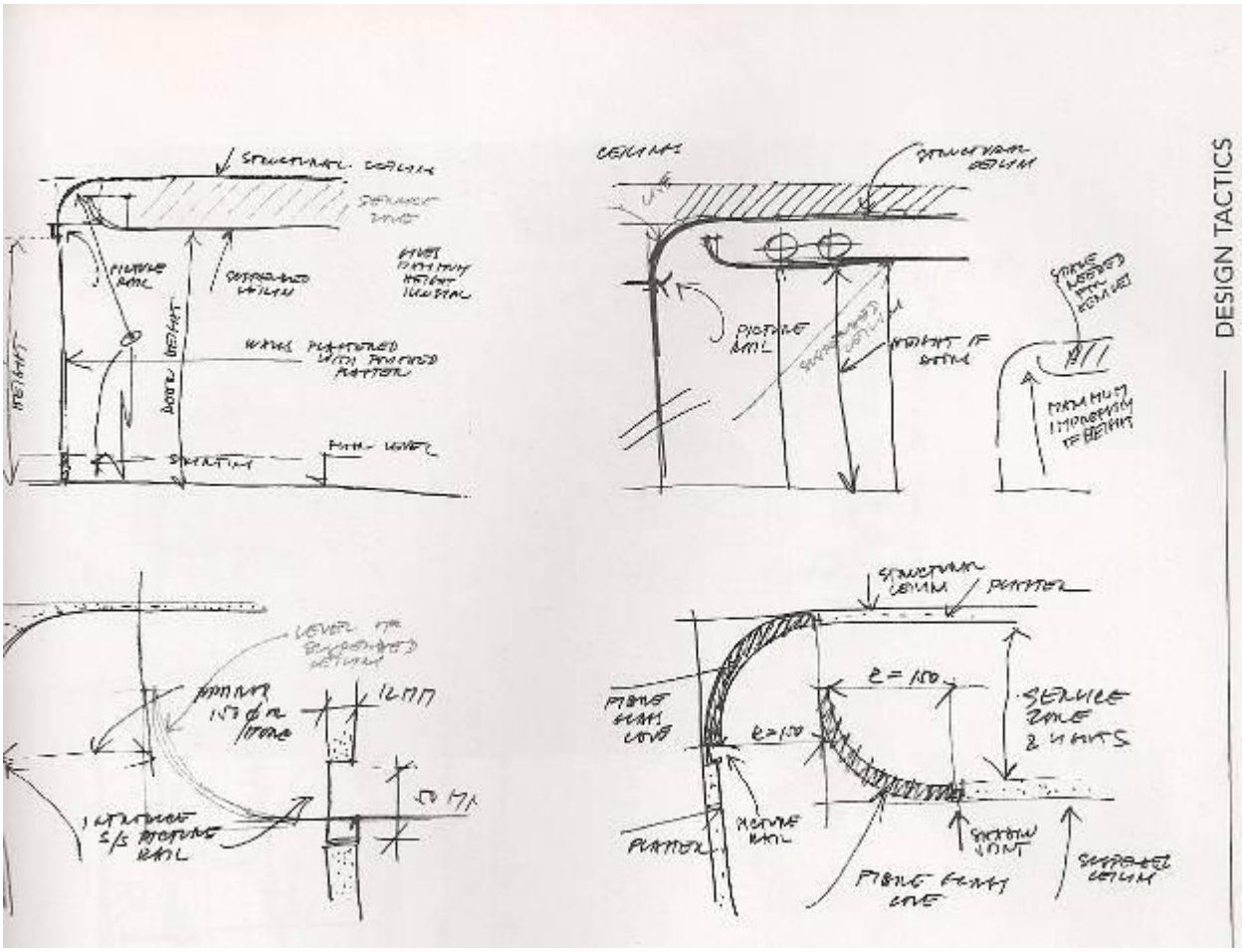


Fig 1: Early sketches from Eva Jiricna's design process showing a line of thought about the junction between wall and ceiling (Lawson, 2006).

That is to say the drawing begins to dominate the conversation, set the agenda and ultimately becomes the designed object replacing the original objective. This trap seems at its most dangerous the further designers are away from the process of making. When a design is highly unlikely to be realized then the drawing inevitably becomes more potent. Sadly, this is the case for the vast majority of design projects completed by students during their education who typically end up developing a conversational style with their drawings that is not entirely constructive (Lawson, 2006).

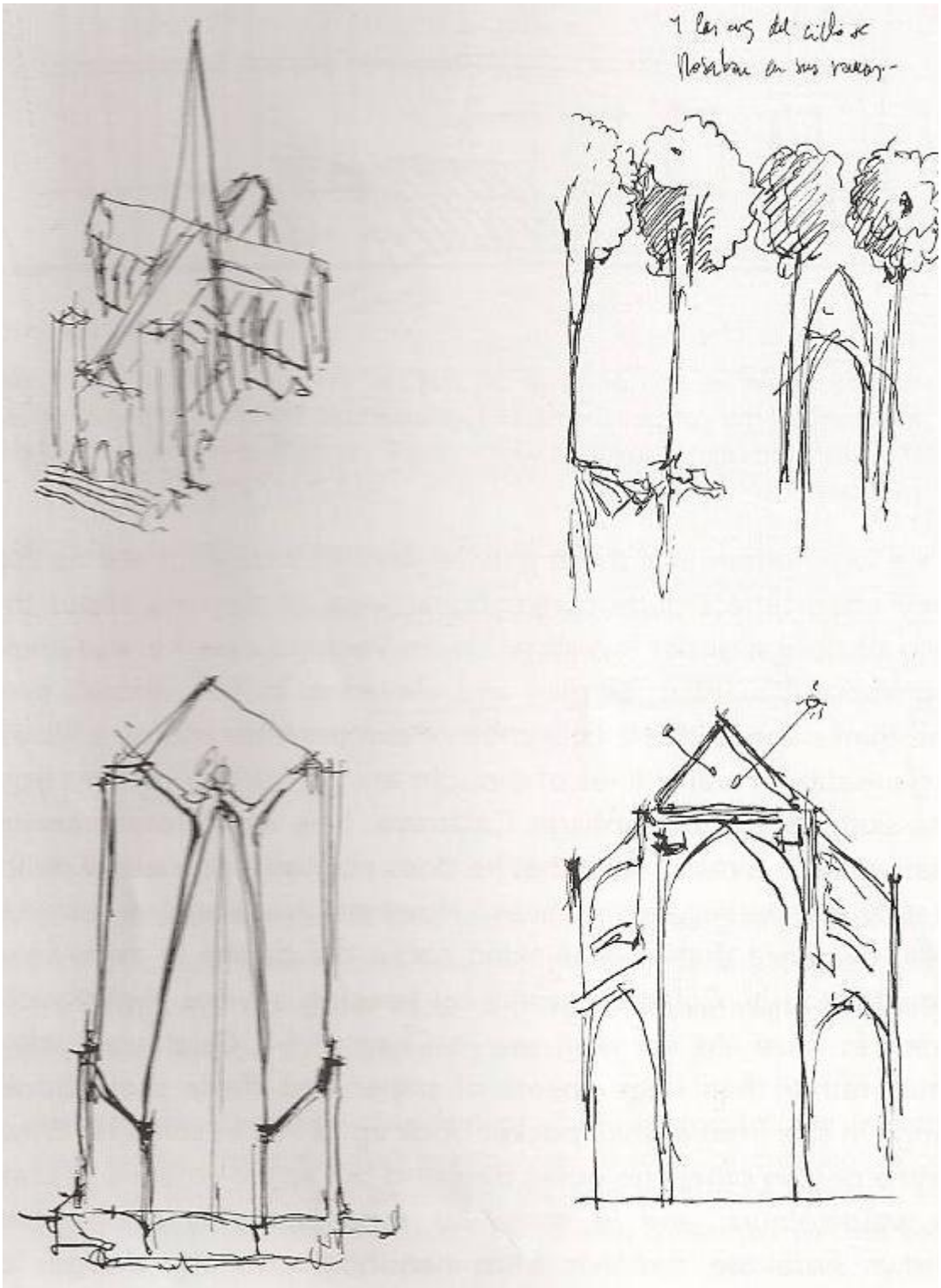


Fig 2: Robert Venturi developing a line of thought about the National Gallery extension as plan (Lawson, 2006).

The "Graphic" Individual

The particular combination of doggedness and flexibility suggests that perhaps a particular personality is helpful for graphic thinking and that design education has a role to play in inculcating the vital skills needed for graphic thinking (Lawson, 2006). Since the graphic thinking process targets problem-solving, analytical thinking – logical, unidirectional, convergent thinking – has to make a complex mélange with creative thinking which is typically more imaginative, unpredictable, divergent and multidirectional. This requires a certain level of intellectual capability as only a "prepared mind" will be able to recognize coherent thought patterns when and if they occur during the graphic process. This is a mind that can conceptualize an unexpected answer, relates previously unrelated elements, appreciates small details, digests expected and unexpected events equally and makes something out of nothing with only the smallest of catalysts.

There is also a fair need for versatility in medium of presentation. Calatrava is renowned for keeping several sketchbooks open at once and is said to prefer small rather than large sheets of paper and these sketchbooks range in size from a small pocketbook up to A3. In some he draws with a pen, in others he works freehand but approximately to scale in watercolours, and in some he even performs calculations (Lawson, 2006). Amongst other things, the subject of graphic medium raises some difficult questions about whether computer-aided design systems help or hinder such a process. What remains key is not what the computer can do but what the computer cannot do. Computers so far cannot design anything similar to the conventional way described in many textbooks. They may be able to solve well-constrained problems, but they cannot design in any of the known fields of design. So where there are computers in use, their purpose must be to aid design and it is best to assume the greatest responsibility and certainly the final say will rest with the human designer. The human designer will necessarily be in a conversational relationship with the computer in which he will have to describe the design state and then interpret some modification of it as suggested by the computer (Lawson, 2006).

THE DESIGN PROCESS: FOLLOWING THE DESIGN TRAIL

Each student of architecture utilizes a combination of graphic, literary, theoretical, mathematical and technical skills every time there is the need to proffer a design solution generated in response to the requirements of the brief issued in their design studios. These are skills that will eventually transform into real-life problem-solving techniques when they find themselves in a competitive work-place. Architects depend heavily on their graphic abilities to properly communicate their design ideas to the client and the rest of the building team through the use of 2 and 3 dimensional presentations made up of building and site plans, elevations, sections, construction details and modeling. The manual process of design has been reviewed in recent times to include the use of computers and other such devices.

The design process is an intricate one made up of both logical and intuitive strategies for resolving basic and generated design problems. It calls for the designer to implement various means of representation to depict the generalized map of the design process which goes through the broad stages of analysis—synthesis—evaluation (Lawson, 2006), some of which include the following;

- Bubble diagrams – a proportional sketch that links the proposed design to the conditions of the building site with regards to orientation and/or zoning,
- Flow charts – which trace the movement or circulation patterns both on the site and within the proposed building,
- Anthropometrics – consideration for human form and scale,
- Space matrices – examinations of the degree of connectivity between designed spaces,
- Schedule of accommodation – computations of minimum required operational space within the design based on anthropometric values and recommended circulation requirements.

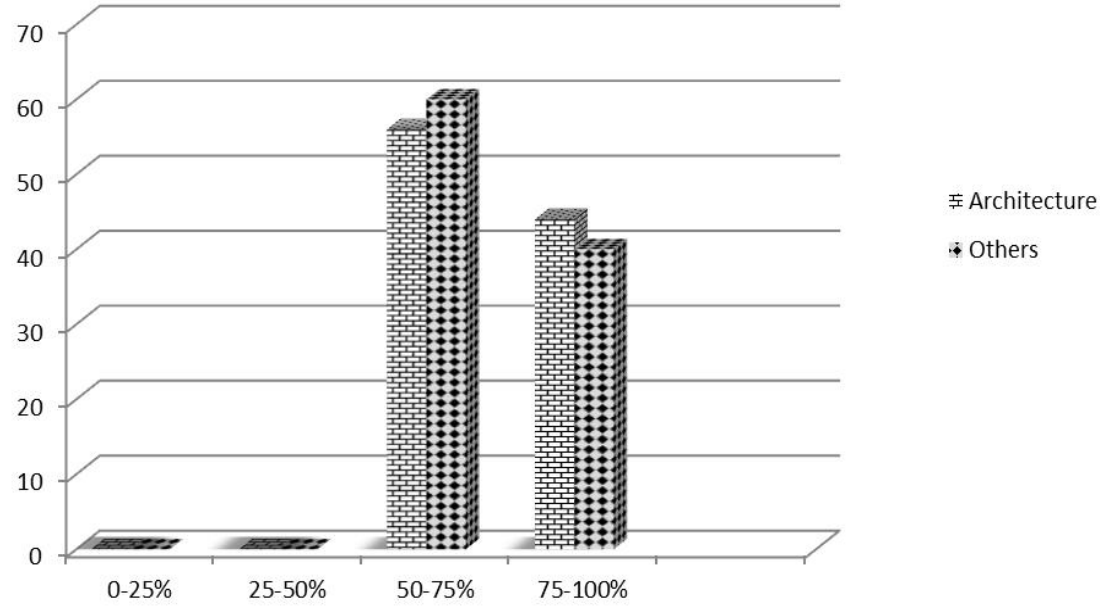
Both in training and in practice, the architect employs graphical means of representing these aspects of the design process and often, their interpretation cannot be made by those who do not

typically perceive data in graphical, not literary, form. Hence the importance of every designer's ability to think graphically cannot be understated.

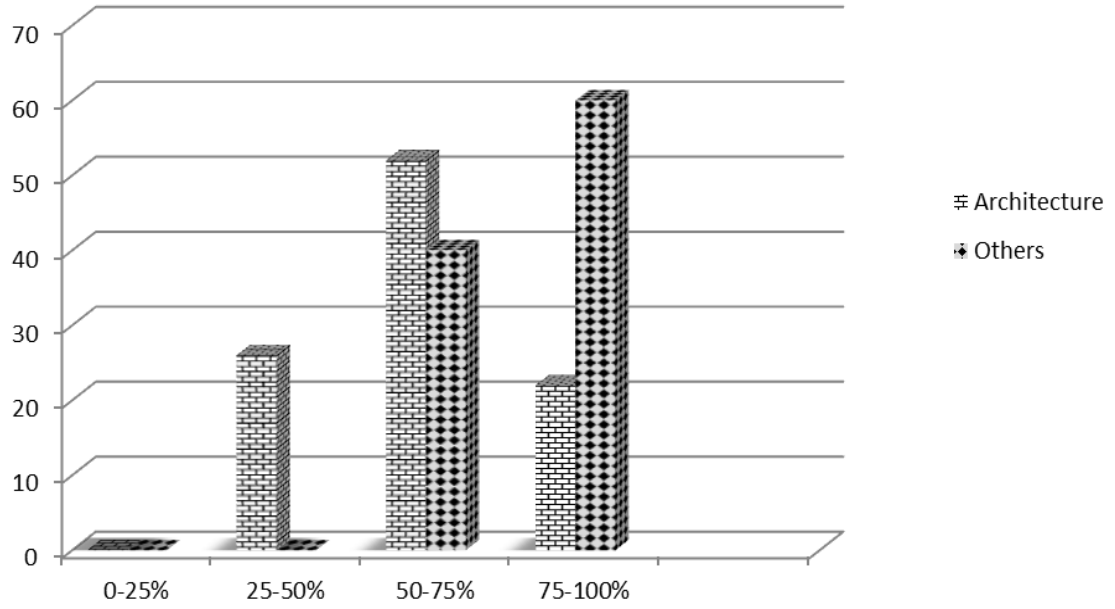
PRESENTATION OF DATA AND DISCUSSION OF RESULTS

Presented below are the results of a primary survey carried out among students at the University of Jos, Plateau state, Nigeria. Students from the department of architecture were issued a standardized personality and aptitude test which were identical to a test given to students from other departments (from both the arts and social sciences) which serves as a control group. The test covered three categories, namely; mathematics, reading comprehension and spatial reasoning. The results of the test are presented thus:

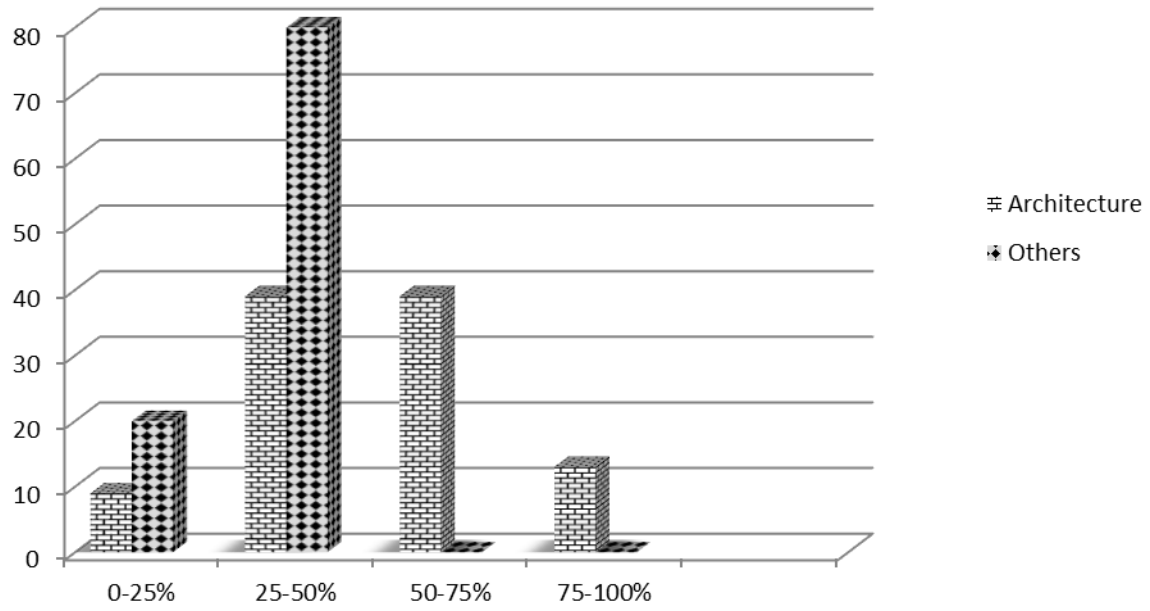
a) Mathematics



b) Reading Comprehension

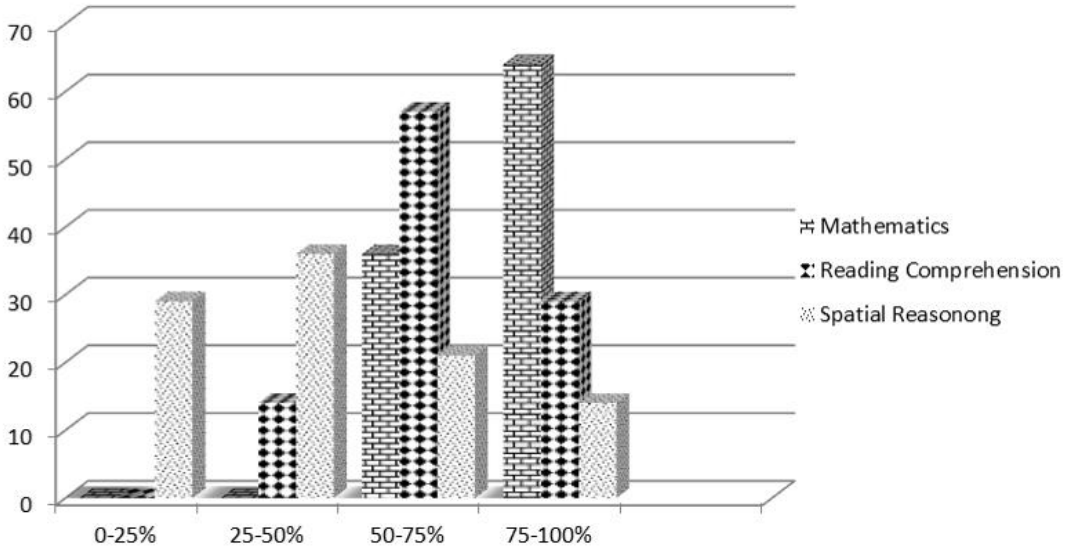


c) Spatial Reasoning

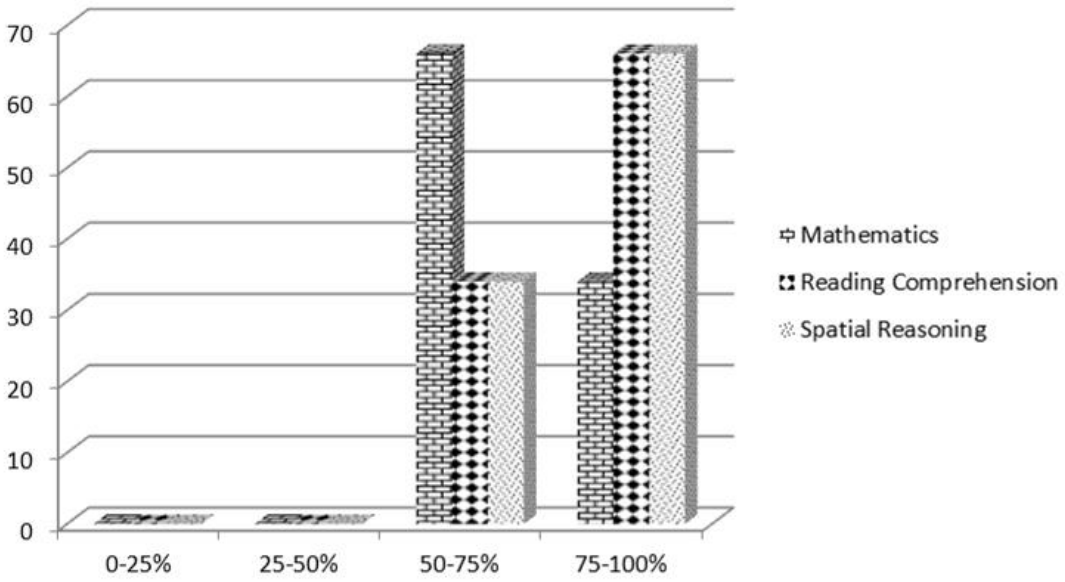


(Fig 1. a),b),c): distribution of scores obtained on standard aptitude test by students in the University of Jos, Plateau state. Source: authors' field work)

a) <u>100 Level</u>



b) <u>200 Level</u>



c) <u>300 Level</u>

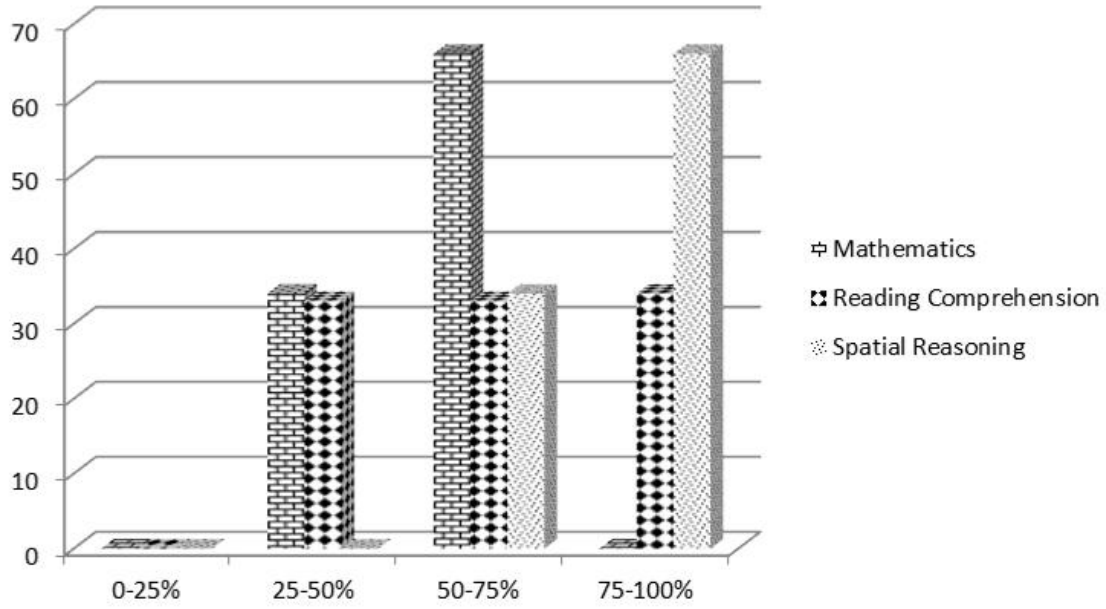


Fig 2 a),b),c): distribution of results obtained by students in standard aptitude test across the first three years of study. (Source: authors' field work).

<u>Discussion of Results</u>

By virtue of their methods and techniques of training, students of architecture typically receive instruction and present their work through various graphic means which encompass two- and three-dimensional presentation. Verbal presentations are limited to jury or screening exercises which require the students to briefly explain points or features in the design that are not apparent in the graphic presentation. Additional theoretical submissions are limited to course work whose content demands interpretation and implementation which is expected to be applied to practical design solutions generated in response to assignments issued in the design studio. This sort of presentation prepares them for the real-life scenario of client briefing and competition where budgets, concepts, time constraints, capability, competence, legal and site requirements etc are debated at length.

All of the respondents in the survey (which comprised both students of architecture and students from other disciplines) demonstrated an almost equal competence in mathematical and analytical skills. A comparison of the breakdown of the results into the various years of study also reveals that mathematical skills are core values exhibited throughout the years of study. Neither the students of architecture nor the students in the control group performed below average in the standardized mathematics section of the quiz. This is indicative of the fact that basic mathematical skill (which deals with ratios, physical quantities and progression) is not necessarily a determining factor on whether or not a student is able to demonstrate the ability to think graphically. However, on the aspect of verbal skill or reading comprehension, students of architecture performed below those in the control group; with less than 75% of the architecture students achieving up to half of the correct answers as against 100% of the students in the control group: the deficiency in reading (or literary) skill is attributed to the fact that very often, students of architecture overlook it in favour more graphic medium of presentation as opposed to verbal or theoretical means of presentation.

However, on the aspect of spatial reasoning, which encompasses topics on proportion, logic and form, students of architecture exhibited a significantly higher understanding with over 50% of the respondents obtaining above 75% of the test questions as against the students in the control group who all fell in the lower 50^{th} percentile in the total number of respondents. This demonstrates that students of architecture who rely on simple anthropometrics to create and present their work are better at spatial conceptualization than their counterparts in other disciplines. Respondents from other disciplines failed to show sufficient understanding in basic aspects of spatial reasoning at the higher levels though interestingly enough, those who are still below their second year of study fared somewhat better. This suggests that as their training in other disciplines advanced, their emphasis on graphic thinking (prompted by spatial reasoning) declined to the point that by the final year of instruction, the ability to convey ideas by way of spatial or graphical interpretations was at an all-time low.

It was also noted that the overall performance in the research assessment was not affected by year of study as over 60% of the respondents who scored 75% and above in the various categories were junior students; however, the results also show that students of architecture in

their first year of study (100 level), attained lower scores in the aspect of spatial reasoning than those in their second and third years of study. A plausible reason for this could be the fact that first year students are yet to participate in any practical exercises in design realization or design studio. At this level, their courses of study comprise mostly foundational courses drawn from the physical sciences, sociology and environmental studies as well as basic methods of architectural graphics and methods of design processes and presentation. Therefore, they are more adept at literary rather than graphical work and improve on their ability to think spatially after they have been introduced to practice and exercises in the design studio.

Tracing the path of the design process equally improves along the years in training, as design students are routinely and regularly called upon to submit their works for formal assessment to their instructors and fellow students during an exercise of public evaluation known as the "jury presentation". Similar to the viva presentation of theoretical and literary professions, the jury evaluation involves open dialogue with a panel of assessors and critics. Unlike theoretical presentations, however, architecture students trace the origins of their design development by graphical means of presentation which include the bubble diagram, flow chart and anthropometrics and are rarely (if ever) assessed only by their results or finished product, but also by the degree to which they traced the origins of their design solution. Members of the control group who responded to the survey had noticeably greater difficulty following similar thought processes without a verbal explanation.

CONCLUSION

Architecture and the other arts hold a vital place in the future of our culture, creativity being one of the most important factors. Architects are problem-solvers and they function as practical unifiers of the arts and the sciences. What may seem unimportant or even irrelevant under pressure of daily life may well be the thing that endures, which may give a community its power to survive (Laseau, 1980).

For designers, graphic thinking increases the output of ideas for the individual. Graphic notation contributes to design by illustrating two important needs: information and processes of working toward a solution of the design problem. Most of the information needed to complete the design

is included in the design brief and the responsibility of transforming the ideas from the brief into the physical form lies with the designer. These are skills acquired through years of instruction or training in design techniques, methods and processes and are core skills required by design students as a means of giving or receiving information.

RECOMMENDATIONS

Based on the study, the following suggestions arise for consideration:

1. In order to enhance and encourage the practice of graphic thinking, and eventually the way architects and other designers will practice in the future, students of architecture should be encouraged to learn and improve on techniques of graphic thinking. Likewise, they should utilize graphic thinking to overcome common design obstacles ("I can't get started…", "I can't get any good ideas…", "I can't make a decision…", "I can't finish…" etc).

2. In many institutions of design education, such as the architectural department at the University of Jos, courses on visual communication are offered as undergraduate courses though they are not compulsory or core courses. Due to the relevance of the course content, students should be encouraged to participate in such programs, where available, to enhance their graphic skill and improve on techniques of design translation and interpretation.

3. Students of design should be encouraged to embrace all and any form or method of graphic freedom including conventional drafting tools such as drawing pens and paper and more recently introduced, computers and other related devices. The aim should be to encourage evolving, yet standard methods of graphic presentation which are essential to design presentation.

4. A study of this nature is constantly expanding and draws no finite conclusion as design education is, by no means, stagnant. Further studies on techniques and methods of various graphic tools for design presentation should be on-going in order to develop and establish additional practices that would enhance architectural productivity and professionalism.

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