STRATEGIC CURRICULLUM FOR EFFECTIVE PERFORMANCE OF GRADUATE ARCHITECTS: THE USE OF CAD AS SIWES COMPONENT

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Abstract

Presently graduates of Architecture are faced with odious challenges to their professional training and the prospect for job opportunities. This is particularly more challenging now than ever before, considering the high level of specialization and current trend of globalization. This paper therefore, examines the concept of curriculum design with regards to entrepreneurship or competency towards an effective performance, the relevance of SIWES and the beneficial use of CAD as an excellent training tool, this is geared towards enhanced career opportunities and performance of graduates in the building industry, considering that the age of pen and ink is virtually gone forever. Finally, the paper proposes an integrated CAD program for use by architects' tramee during SIWES for an effective performance at graduation.

Introduction

The present trend of globalization, and specialization in a highly competitive economy, and the need for the developing countries to meet up the emerging challenges are quite urgent. Any meaningful attempt at actualization of self-reliance, through appropriate or adaptable techniques for manpower training is important. The singular most valuable resource for development and entrepreneurship being humans, our training institutions must therefore, rise up to the occasions; foremost through an effective curriculum planning, development and implementation. This must be based on current trends of research and applications particularly in the area of information technology (IT) application as regards Computer Aided Design (CAD) and its related programs.

An integrated CAD training should be designed as part of the well established and run Student Industrial Work Experience Scheme (SIWES) program for our technology graduates in training. Once a well focused analysis of the current problems in computer related program training is enhanced and incorporated as part of our SIWES, we would have set a reliable base ground for further relevant training towards effective performance of our graduate architects and indeed other technologically based courses. This is with the belief that no society can develop without a well-focused technologically based workforce complemented by good management skills.

AUTOCAD and its related devices are the major language of communication in the building industry for now and will gradually replace all other media of presentation sooner than later. Hence if our graduate Architects must fit into the labour market they must learn and become proficient with all forms of contemporary design presentations and their medium, allied or related fields of architectural technology, project management, landscape and applied science. Never again should a graduate Architect be principally only a design expert but rather a holistic specialist in all or at least in more than one of the available fields of study in the building industry. This would certainly require a review of our current curricula first in the theories that are in no short supply in our schools and also during his or her periodic moments of attachment with the different Architectural firms under the supervision of SIWES program.

It is worthy of note that if the practices will be central to the training of students for effective performance in the contemporary building industry in specific and the economy at large, these must be strategically provided:

- Government to provide an enabling environment for free enterprise and development.
- Schools curriculum must be reviewed to cater for all the numerous shortfalls prevailing presently
  in the system (i.e. appropriate courses and course contents).
- A fair and trustworthy due process must not only be set up, but should be institutionalized with
  competent professionals in all sectors particularly the building industry. This will encourage
  healthy competition and good productivity, thereby assessment based on favoritism and

nepotism
must be gone for good.

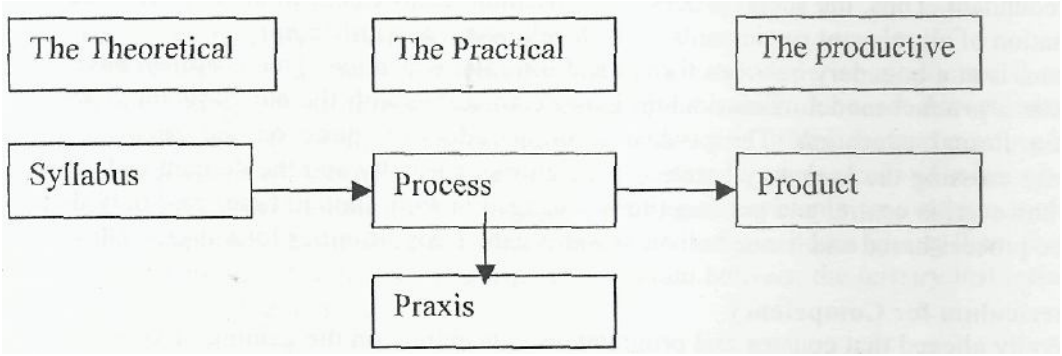
Firms' acceptance of trainees and definite participation in SIWES program could be part of the evaluation towards securing any commissions.

- Students' project submission must be based on life project experience and practical actualization before approvals are made.

Curriculum Design for Graduate Architects

Curriculum has its origin from Greek, meaning racing chariots tracks. Literally it was a course derived from *currere* (to run). It is however, useful to start with John Kerr's definition, as "all the learning which is planned and guided by the school, whether it is carried on in groups or individually" (quoted in Kelly, 1999). This shows that learning is planned and guided for meaningful product. And as stated by Aristotle categorization of knowledge is an embodiment of the *theoretical, the productive* and *the practical* (Aristotle, 1976) Figure 1 below.

Fig. 1 (Ways of Approaching Curriculum Theory and Practice)



Blenkin, also, stated that curriculum is a body of knowledge-content and /or subjects.. Education in this sense is the process by which curricula are transmitted or 'delivered' to students by the most effective methods that can be devised (quoted in Smith 2000:3). Curriculum therefore is that series of experiences which students must have by way of obtaining the objectives of showing their abilities, attitudes, habits appreciations and forms of knowledge that man really needed. This must provide a clear notion of outcome so that content and method may be organized and the results evaluated.

Recently however, curriculum is defined by Grundy as: "A program of activities (by teachers and pupils) designed so that pupils will attain so far as possible certain educational and other schooling ends or objectives" (quoted in Smith, 2000:6). The problem here is that programmes exist prior and outside the learning experiences, taking much away from learners. However, for our purpose this divergent point should be the particular variance between university and polytechnic curriculum. While the university curriculum should guide towards freedom of learning and creative propositions, the polytechnic system will more specifically depend on execution of designed programmes to be judged by the product of their actions- teaching.

Furthermore, curriculum can be said to be a *process* allowing for interaction of teachers, students and knowledge. Curriculum is thus, what happens in a classroom and what people do to prepare and evaluate. According to Stenhouse; in Smith (2000:8), *"A curriculum is an attempt to communicate the essential principles and features of an educational proposal in such a form that it is open to critical scrutiny and capable of effective translation into practice.'"* He, therefore, finalized that, curriculum just like a recipe can be varied according to taste. Thus, as a minimum, curriculum should provide a basis for planning a course, studying it empirically and considering the grounds of its justification. In summation, curriculum as a process *is first,* a way of translating any educational idea into a hypothesis testable in practice; *secondly,* it must be verified by each teacher in his/her classroom; *thirdly,* that the content and means develop as teachers and students work together and *fourthly,* focus is on interactions, attention shifting from teaching to learning.

Curriculum as a praxis is in furtherance of the development of the process model. In curriculum *as praxis* teachers enter particular schooling and situations with a personal, but shared idea of the good and a commitment to *informed* and *committed action.* They continually evaluate the process and what they can see of outcomes. According to Gamely " *The curriculum is not simply a set* of plans to be implemented, but rather is constituted through an active process in which planning, acting and evaluating are all reciprocally related and integrated into the process" (quoted in Smith,

2000:14).

Contextualization of Curriculum

A proper appreciation of the discussion on curriculum development cannot be completed without contextualization with regard to the training of our graduate Architects and the prospects for career opportunities at graduation. The context for development of curriculum for graduate architects must include the socio-economic, cultural and environmental realities of the times. Cornbleth (1990) contends that curriculum as practice cannot be understood adequately or changed substantially without attention to its setting or context. Often referred to as 'hidden curriculum.' Kelly (1999), argues that because of the way schoolwork is planned and organized but are not overtly included in the consciousness of those implementing the curricula, the notion of hidden curriculum therefore, becomes rather redundant. Thus, the social process of curriculum contextualization is limited due to improper coordination of all relevant participants in its development and utilization.

Curriculum, is at a boundary between formal and informal education. This is argued base on the supposition that *a product* model of curriculum is not compatible with the emphasis *on process and praxis* within formal education. Thus, when informal educators take on the language of curriculum they are crossing the boundary between their chosen specialty and the domain of formal education. This, however, is central and pertinent to be engaged in from time to time. And only then can our product be process based and hence holistic towards career opportunities for our graduates.

Appropriate Curriculum for Competency

It is generally alleged that courses and programmes concentrate on the gaining of knowledge and theory and neglect performance; meanwhile it is performance that essentially characterized competence (Jessup, 1989). For graduate Architects to have good career opportunities their qualifications must be cast into specific statement of competence in all fields of the building industry.. This is particularly so urgent in the light of the high level of encroachment by allied professionals in the Architect's recognized domains. The problem is prominent in the field of management that has now seemingly placed itself at the head of the leader in the building industry. The competence of the Architect in practice and of course his trainee had been questioned for some times now. A wake up call to all schools of Architecture must be made now and should be very definite and effectual.

Adeyemi (2004), did advocate at the inauguration of Alumni Association of Zaria Architects (AAZA) in 1979 for Architects/specialists for areas of diversities as: *Contract Administration and management, Urban planning (with a view to making inroads into the design of cities and rural settlements), Specific building types, Landscape Architecture and design, Building technology, Research, teaching and project propagation.*

This would be a more desirable review of education curriculum towards improved opportunity for graduate Architects. In another address to CAA congress of heads of school (African region) in 1991, Adeyemi identified the main stream of specialization for second tier program of Architectural training to include: *Architectural design Architectural Technology, Archil ".:[f]'iral management, Architectural landscape, Architectural science (illumination, lighting, acoustics etc), under Architectural science we can have computer training (aided design).*

The lack of curriculum specialization by Architectural schools had limited them both in terms of population intake, infrastructures provision in terms of accommodating space and thus being choked by allied professionals in the building industry. This of course constrains their graduates to the area of design, often contracting and some crafts. A more specialized curriculum for all schools of architecture will certainly lead to a broad scope of opportunities for our graduate Architects. Thus Architecture must once more return to its holistic yet specialization through up to date curriculum for our survival and indeed sustainability in the mix of stiff competition in the building industry and the increasing globalization that requires nothing for survival but specialization and good entrepreneurship.

The definition of Architecture according to the ARCON amended decree section 13 of 1990 states:

> "Architecture as the art and science in theory and practice of design, erection, commissioning, maintenance and management and coordinating of allied professionals thereto of buildings or parts thereof and the layout and master plan of such building or groups of building forwarding a comprehensive institution establishment or any other neighborhood as well as any other organized space, enclosed or opened, required for human and other activities.[1]"

This definition clearly shows the precarious position we have found ourselves as Architects and the desperate moves being made to salvage our glorious statue in the country at large and the building industry in particular. Indeed it also points to the numerous opportunities that are there for an appropriately trained Architect. Having highlighted the broader concern of this topic we would proceed to the specifics to discuss our particular area of choice for contribution towards enhancing graduate Architects. This is principally through (he appreciation of CAD during SIWES attachment periods, and the relevant skills that can be acquired that could assist in their career opportunities.

SIWES As **An Effective Training Medium**

SIWES is the acronym for students' industrial work experience scheme. It entails the skill-training program, which forms part of the approved minimum academic standards in various Degree/Diploma/NCF for all tertiary institutions. It seeks to bridge the gap existing between theory and practical aspect of Architecture, Engineering and other technological and science based courses in Nigeria's tertiary institutions- It is aimed at exposing the students to machine tools, professional works areas and workers in industries and other organizations, hence giving them the pragmatics of their field of studies. The scheme is a tripartite program between the tertiary institution, the industry and the industrial Training Fund (ITF).

Goals of the scheme

The scheme is geared towards a number of goals to include:

(i) The provision of avenues for acquisition of skills and experience in the course of study of the student.

(ii) The preparation of the students towards work situations after graduation.

(iii) The exposure of the students to work methods and technique in handling equipments and machinery that may not be available in the institutions.

(iv) Bridging the gap between higher education and actual practice by providing the students the opportunity to apply their theoretical knowledge in real work situation.

(v) Enhancing students' contact for job placement after graduation.

(vi) Enlisting and strengthening employers involvement in the entire educational process of preparing school graduates for employment in industry.

Assessment Criteria

The assessment criteria for this scheme upon completion by the student include the following: Technical report writing. Logbook entrv. Oral interview. Industry based supervisor's evaluation (attendance/punctuality, attitude to work/cooperation, performance/initiative), hist Hut ion visiting supervisor. Job specification, Seminar and presentation.

Considering the goals of (he SIWES scheme, particularly that of enhancing students' contact for subsequent job placement after graduation and Hie fact that computer utilization has become a major means of Architectural graphics communications. We hereby wish to emphasize the need and relevance of CAD for any trainee Architect as a SIWES tool.

CAD As a Utility Tool

Automated computer aided design, otherwise called 'the electronic drawing board[1], cannot be discussed without the knowledge of what a computer is. A computer could be defined as an electronic device, which under the control of stored programs accepts data as input, processes the data and produces the output as information. Computer Aided Design (CAD), is said to be the modeling of physical systems on computers, allowing both interactive and automatic analysis of design variants and the expression of designs in a form suitable for manufacturing (Sunday, 2002). Thus, simulation can be said to be far more important part of CAD than design description.

To be successful in design, professionals require not only talent and creativity but also a careful balance of technical skill, business sense and artistic expression. One hopes to find this balance in the professional area of Architecture. CAD is a valuable tool in the service of this profession. Computer assisted design provides a valuable and ever developing tool for the advancement of Architectural creativity in producing unique design solutions to modern problems and needs. The introduction of CAD into Architectural utility tool has saved the Architect the strain of table drafting in different ways:

Speed - The speed of a computer is so great that it can perform functions that will normally last for days under a few hours. In the case of CAD, it has made drafting and designing much easier and faster for the

Architect as much as 500% (Kurland, 2004). Some of the latest versions of AutoCAD go beyond drafting to generate alternative roof plans and elevations. This, thereby, frees the Architect to concentrate on the other areas of specialization he dearly needs for relevance and higher value of time usage, leading to maximization of the Architects other specialization fields in addition to design.

Accuracy - Unlike manual draughting that is often inundated with exaggerated elements, CAD takes measurement to the least decimal points, making every object proportional to one another. This precision goes as far as measuring small elements like window frames, aluminum flashing, etc. These are not represented to scale when drawing on board to small scale, i.e. 1:200.

Storage ***and Filling-*** The computer has the ability of storing a large volume of data and processed information, in floppy disk, CD ROM or micro vault (flash disk) for easy handling and transportation. A hard copy of any document is not easy to handle and transport particularly for a long time. A hard copy of CAD drawings can be stored for as long as a decade or two, depending on the storage medium.

Revision - In a situation where there are number of revisions to be made on design, manually drafted designs become rough and not appealing to the eyes. On the contrary CAD generated designs make revision so easy that after reviewing them and correcting the necessary part, the output takes such an incredible short time but still looks as neat as the original drawing.

Comfort - No matter how mechanized a drawing board is, it stresses the body and indeed the brain a great deal, but with CAD, an Architect can sit more comfortably with his computer and presented with various options for choice. Thus, he can be engaged in serious work and yet enjoying great deal of comfort and convenience being accompanied with music on CD and other entertainments, leading to higher efficiency.

Simulations - Simulation is the act of presenting something that is not real as if it is **real.** In CAD usage, architectural drawing can be simulated and presented to the client to his delight. This can be achieved by producing a number of animations with which the client can be taken through his building and round it. This fascinating walk through a proposed project is such that can never be dreamt of on the drawing board. This does not only help the Architect explain the design, but it also gives the designer good visual view of the feasibility or otherwise of his proposal. While CAD software is effective in creating two-dimensional (2-D) drawings, its most sought after ability is that of three-dimensional (3-D) models. The designer should be able to decide which CAD software he most prefers for his required purpose.

Presentation - The contemporary mode of presentation has been placing of drawings on boards or platforms for discussion. With the help of AutoCAD, drawings can be presented on the screen of the computer, and can be viewed on bigger screen through the help of a projector even to a life size.

Distant Participation - With the aid of computers architects staying in different geographical locations or regions can work on the same project. This is through networking like wide area network

(WAN) or local area network (LAN). In fact, principals of firms can more conveniently direct flow of activity far away from their office, thereby, ensuring the most appropriate quality of work expected even while away on other pressing assignments.

CAD Relevance in SIWES

Our survey is towards reinforcing the relevance of CAD as an important tool in ensuring an improved graduate Architect and thereby preparing him for better job opportunity. Therefore, considering the fact that most of our schools do not have the required facilities for effective CAD training. We advocate a direct inclusion of CAD training as part of SIWES program. A study of trainee students in various firms was carried out with the following objectives:

(a) To ascertain those graduate Architects who are CAD compliant as a result of SIWES exercise.
(b) Ascertain the significance of CAD proficiency in securing job opportunities or determining level of competency in their place of work.
(c) Establish the need for genera! CAD training for all students in the course of SIWES training exercise.

Methodology

We took sample of some trainees of SIWES program for the years 2001-2005, with respect to CAD appreciation for Kaduna Polytechnic students (our specific domicile) and hence primary point of assignment and expected place of contribution to the actualization of challenges of career opportunities to graduate Architects in general and polytechnic in particular.

Data Collection/Presentation

The samples used were the assessment scores of the students from the department of Architecture as well as opinions of the companies or firms where the students had their SIWES training.

Table 1: (NOII Students of Dept. of Architecture, Kaduna Polytechnic Before Commencement of SIWES Program from 2001 to 2005 Showing Their Knowledge of CAD)

S/No.	Year	No. of Students	No. with CADD	% with CADD	Remarks
1	2001	75	02	2.6	Poor
2	2002	87	01	1.1	Poor
3	2003	117	04	3.4	Root-
4	2004	127	02	1.5	Poor
5	2005	161	01	0.6	Poor
Total	5 years	567	10	9.2	Poor

Source: Field Survey.

Appendices A and B, show NDII students of department of Architecture Kaduna Polytechnic on commencement/completion of SIWES program for 12 firms selected between 2001-2005, in Kaduna.

Result Analysis and Discussion

Table I shows the number of NO II students before the commencement of the SIWES program. This table reveals that out of the 567 students in ND from 2001 to 2005, only 10 of them had a fair knowledge of computer application using CAD before the commencement of the SIWES program. This represents a disturbing rate of only 9.2% of the total number of students in ND program for the said period.

Appendix B shows that on completion of SIWES program from 2001 to 2005, the students had a tremendous knowledge of CAD with the following percentage scores: 2001 —-55%; 2002—-53%; 2003-—54%; 2004—-46%; 2005—45%.

The fluctuation in the percentage was as a result of the increase in admission intake, which has a resultant negative impact on their CAD knowledge, since most of them were engaged in ministries for their SIWES training where there are few computers if any for the staff usage. This was in contrast to private firms, which are highly equipped but have limited spaces for students on attachment. Our survey/discussion with the firms and many others shows there is higher preference for graduates that are CAD compliant for employment. Others are usually given employment reluctantly with strict or less favorable terms. Appendix C is a proposed program that is designed to be incorporation as part of SIWES training while in school. This will ultimately improve their CAD skill as graduation and thus professional competence.

Recommendations and Conclusion

(a) For an improved career opportunity the curriculum should be process-product oriented.
(b) The teaching staff should be reoriented towards the specific goals of each curriculum both for the universities and the polytechnics. This will lead to a result oriented teaching staff and graduates that will be useful to their society.
(c) Similarly, formatted SIWES product survey should be carried out for other institutions and for allied professional trainee students for good comparism. It will also further illuminate the significance of CAD training as being integral for improved career opportunity for graduate Architects.
(d) It is pertinent to ensure strict intake standard that is based on availability of training facilities and SIWES placements in appropriate firms to ensure effective performance at graduation.

Finally if there must be any career, if there must be any opportunities and if the graduate Architects must survive amongst his professional colleagues and within the competitive society, there must be a curriculum that is both process and product based.

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Appendix A (NO II Students of Department of Architecture, Kaduna Polytechnic on Commencement/Completion of SIWES Programme from 12 Firms in Kaduna Selected Between

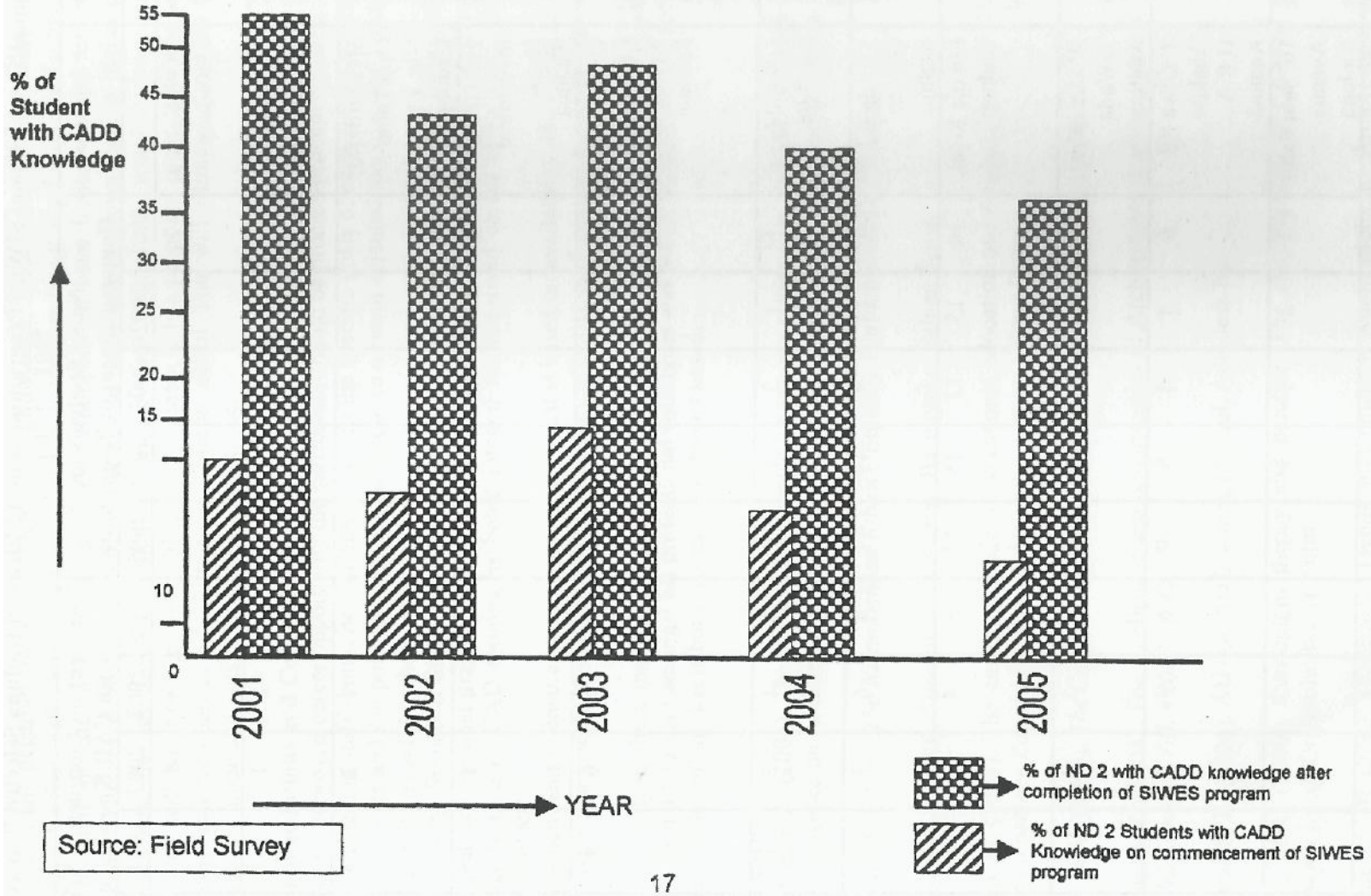
2001-2005)

S/N	Company	Address	No. of Students on Commencement of Programme					Student on Completion SIWES with CAD Knowledge				
			2001	2002	2003	2004	2005	2001	2002	2003	2004	2005
!	Datum Construct) on Ltd.	94/96,Kachia rd, Kaduna	2	1	4	3	5			1	2	1
2	District Design Group	6B, Idoma Rd. Kaduna	3	2	1	3	1	3	2	1	1	1
3	Bjim and Associates	SBTextileRd, Opp Tabia Nig. Ltd, Kaduna	1	2	2	3	1	1	1	2	2	1
4	Bnvironme nt Seven. Ltd,	27, AM Rd, Investment House Kaduna	2	4	5	4	- 3	2	4	5	4	3
5	Fed. Ministry of 1 lousing and Urban Developme nt	Federal. Sec. Complex, Kawo Kaduna	9	10	15	17	10	2	5	6	4	3

6	Furtune Dzyn Consultant	6, Zambia St. Barnawa	I	1	2	1	1	1	1	2	1	1
7	K.S.D.P.C	5,LafiaRd. G.R.A, Kaduna	10	15	8	12.	17	4	6	3	4	5
8	Kaduna State Ministry of Work	Lokoja Road, Kaduna	10	15	12	15	18	3	4	3	3	5
9	Kaduna Polytechni c	Works Dept, T/Wada Kaduna	9	10	8	10	10	4	3	3	4	4
10	Archon Nig. i.td.	8,GiwaRd. Abakpa G.R.A Kaduna	6	4	4	5	4	6	4	4	5	4
1!	Archimode s Associates	10, San i Sabo Avenue Kaduna	3	2	3	1	3	3	2	3	1	3
12	Triad Associates	29, Raba Rd. Malali Kaduna	4	6	4	5	4	4	6	4	5	4
Total	12		60	72	68	79	77	33	38	37	36	35

Source: Field Survey

Appendix B (Percentage of ND2 students with CAD knowledge on commencement and after completion of SIWES program)



Source: Field Survey

Appendix C (Proposed Integrated CADD Program During SIWES for Tertiary Institutions, i.e. Polytechnic)

Program: ND in Architecture.

Aim: To produce technicians who can handle design projects from production drawings to printing using CAD.

Course Title: Computer Aided Design And Drafting (CAD).

Goal: To ensure the exposure of the student to the use of software in CAD during the first four weeks of their sixteen weeks of SIWES program.

General Objectives: On completion of this course, the student will be able do the following:
1.0 Get started, draw and edit using various softwares (i.e. AutoCad, ArchiCad, Design Cad, etc).
2.0 Layering (about 256 colours).
3.0 Adding text/Dimensioning-using CAD.
4.0 Using attributes and Polylines.
5.0 Printout completed drawings.

General Objectives	**Performance Objective (Specific Learning Outcomes)**
1.0 Get started, draw and edit using various soft wares	1.1 Know how to boot and exit your computer, 1.2 Know various AUTOCAD command tools. 1.2 Know how to draw plans and generate El., Sections of various shapes/forms.
2.0 Layering for CAD.	2.1 Know how to set different objects on different layers. 2.2 Know how to freeze layers in complex building. 2.3 Know how to change associated colours/other properties of the various layers.
3.0 Adding text/dimensioning-using CAD	3.1 Know how to add text on a drawing and edit as appropriate. 3.2 Know how to dimensions drawings of various shapes and sizes. 3.3 Know how to specify different properties for texts and dimensions.
4.0 Attributes and poly lines.	4.1 Know how to create or define attributes for any object on CAD 4.2 Know how to change attributes specifications. 4.3 Know how to edit define various line thickness on single object
5.0 Printing drawings on AUTOCAD	5.1 Know how to layout drawings in model and paper space. 5.2 know how to draw panel showing border and title block on your drawing sheet. 5.3 Know how to create hole on your drawing sheet to reveal object drawn. 5.4 Know how to scale and print out drawings.