

Competency-Based Supplementary Instructional Modules in Computer-Aided Drawings (CAD) in Selected Schools in Batangas

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Abstract: *Several challenges have been raised years after the new curriculum has been institutionalized like the readiness of the teachers, and insufficiency of learning resources and materials. With that, the researcher explored the experience, challenges, and supports needed by eight (8) teachers in teaching Computer-Aided Drawings (CAD) in some public secondary schools in Batangas through a qualitative inquiry using in-depth, face-to-face structured interviews with an end in mind of developing an instructional learning module. Results indicated that among the challenges of drafting teachers are lacking and unavailability of drafting materials, learning spaces and computer units with licensed AutoCAD software, as majority of them are using unlicensed software. Teachers admitted that they are using their own salary to procure materials and even solicit financial support from their friends. Additionally, the availability of adequate, DepEd curriculum-aligned, and updated learning materials in the teaching of the subject was also found as one of their problems. However, despite these shortcomings, it was concluded that some teachers are providing alternatives in an attempt to deliver quality CAD instruction, they agreed that they find it difficult to teach the subject without proper equipment and learning modules. Majority of the students exiting the program passes the competency assessment of TESDA, making them eligible for national certificates. However, some schools are not submitting their students for competency assessment with a fear of failing due to lack of complete and adequate training.*

Keywords: *Computer-Aided Drawings (CAD), Information and Communications Technology, Technology and Livelihood Education, Technical Drafting, Learning Modules Development*

I. INTRODUCTION

Quality education fundamentally contributes in the production of quality human resources who are able and competent to work towards the furtherance and sustainability of the national development. These human resources deliver professional and technical knowledge to the societies, represent the country's workforce, and signify the strength and assets of the nation.

In the Philippines, the education system aims to provide for a broad general education that will assist each individual in society to attain his/her potential as a human being and enhance the range and quality of the individual and the group. (Education Act of 1982, section 4). The Philippine government guarantees equal and accessible education at all levels. The support of the national government from elementary, secondary and tertiary education is noticeable as much higher budgetary allocation is given to education. President Aquino's signage of the Republic Act 10533 otherwise known as the "Enhanced Basic Education Act of 2013" or the K-12 Program last May 15, 2013 connotes the country's biggest educational reform. This aims to enhance learners' basic skills, produce competent citizens, and prepare graduates for lifelong learning and employment. This highlights the universal Kindergarten, additional two years in the Senior High School and strengthening the learning areas by introducing tracks

chosen by the students (i.e. Academic; Technical-Vocational; and Sports and Arts), undergoing immersion, which provides relevant exposure and actual experience in their chosen track and many others are some of its features.

This hopefully will solve issues pertaining to unemployment, underemployment and job mismatched of our graduates is also the concern for this program. Technology-Livelihood-Vocational Track, one of the tracks offered under the K-12 Curriculum, covers four major areas namely: Agriculture and Fishery Arts, Home Economics, Industrial Arts and Information and Communications Technology. Each area is comprised of different areas of specialization which are designed to equip the learners with relevant knowledge, skills and attitudes that will lead to the acquisition of certifiable skills in preparation for higher education, the world of work, or entrepreneurship. The integral parts of this strand are different methodologies, hands-on application, and practical work activities that will enable the students to learn, acquire and apply the competencies in different fields of specialization (Corpuz and Salandanan, 2016)

Technical drafting, one of the areas of specialization offered under Industrial Arts has been an integral part of every area of TLE since all topics include interpretation and creation of plans, blueprints, layouts and designs. Pattern making in dressmaking, plot illustration and planning in agriculture, elevations in carpentry, isometric layout of plumbing works, blueprints in welding, schematic diagram drawn in electricity and electronics are some of its applications. It further enhances the knowledge, skills and attitudes of the learners in acquiring the Technical Drafting NC II Certification. It consists of competencies that a person must achieve. It consists of competencies that a person must achieve to enable him/her to draft architectural layout and detail (structural, electrical/electronic, sanitary/plumbing, and mechanical) drawings using both CAD system and manual drafting methods. A person who has achieved this qualification is competent to be a draftsman or a CAD Operator.

As observed, the usual teaching of Technical Drafting in public secondary schools depends on the theories and activities provided by textbooks. The subject is being delivered by the teachers through life skills and experiential learning using set of individuals and group activities, demonstrations and practical application of presented theories. On the other hand, concerns in meeting the objectives prior to the teaching of the subject, adequacy and appropriateness of the concepts taught lack priority due to noticeable insufficiency of budget allotted, limited instructional materials, learning spaces and laboratories used by the instructor and students burden the quality of education perceived by the students.

In this regard, proper intervention of the teachers in crafting and preparing instructional materials appropriate in teaching Technical Drafting is very important. This is so to provide enhancement and enrichment of learning. Instructional materials are the tools teachers should not forget to use while having classes. Good instructional material has a big impact on the students learning since they learn most by doing. The adequate number of units in proportion with the number of students should also be observed. Through Instructional Materials, the teacher will be able to make his/her strategies in teaching more effective and meaningful. Also, it is much easier on the part of the students to learn and to understand their lesson and to acquire the skills more meaningfully.

To address the need for advanced and relevant curriculum-based education, the development of supplementary instructional materials which are very useful in teaching the subject technical drafting is but very timely. In light of this, a supplemental instructional material bounded with updated and relevant concepts and theories incorporated with the application of entrepreneurship, technology and many related ideas. Inclusion and consideration of variables in making a comprehensive, learner-centered and sensitive and user-friendly instructional materials like modules, books and workbooks should be attained by its output.

The researcher is aware of the importance of producing supplementary instructional materials for the effective instruction. The researcher's objective of producing relevant instructional materials in the form of modules will surely contribute a very significant level of attaining the objectives of everyday lessons. Also, the researcher observed that several schools were teaching specialization subject of Technical Drafting due to lack of expertise of the teachers and the provisions for updated, available and relevant instructional materials to support the teaching of the subject. The awareness of the researcher on the issues and the observations of these have become the inspiration of the researcher to pursue this study. Thus, this paper intended to develop a competency-based supplementary instructional modules by exploring the experiences of Technical Drafting teachers, describe the distinct features of Computer-Aided Drawings (CAD) for the instruction of Technical Drafting and identify the challenges and supports needed in delivering quality instruction in line with CAD.

II. RELATED LITERATURE

Numerous researches that have been conducted relative to the problems encountered in the teaching of TLE and instructional materials development have greatly influenced and broadened the understanding of the researcher about the topic. Martinez, et al. (2016) stated that the problems that affected the motivational level of the students were anxiety and confidence in the ability to express their feelings about the subject, accomplishment of all the requirements needed in the subject and type of classroom structure and instruction that best facilitate their learning. Meanwhile, Alvez et al. (2016) found out that among the issues and concerns met by the teachers in enhancing skills and competencies of the students were lack of electronic tools and equipment and lack of conducive and well-ventilated electronics laboratory in performing practical activities. They further stated that the prepared instructional materials with the aid of computer were deemed effective than the traditional instructional materials.

Moreover, the findings of the study of Dinglasan et al (2017) revealed that TLE instruction in the K-12 curriculum shall be performance and outcomes based in which learning modules shall be aligned with and adopted to the guidelines set by DepEd and other educational institutions. Also, as observed by the researchers, instructional materials used by teachers are out-of-date, incomplete, and somehow irrelevant to the skills of the students. Survey questionnaires revealed that demonstration and the use of specimens were always utilized by the teachers as instructional materials in teaching Baking. They also added that the standards set in the development of the instructional materials shall cover the three domains of learning which is the cognitive, affective and psychomotor in which the delivery of instruction specifically in baking shall ameliorate the knowledge, skills and attitude of the students through hands-on, technical, practical, and value-laden learning activities.

The study of Atienza (2015) cited that in the implementation of the K to 12 curricula, many teachers were affected especially science teachers due to the adoption of the spiral progression approach. According to her, there were seminars conducted to address the problem but it seems not sufficient especially in improving science teachers' content knowledge in different content areas of Science. The findings revealed that in terms of learning resources, printed materials, technological materials, laboratory materials, and laboratory equipment and facilities were somewhat adequate. Teachers also often used different traditional and authentic evaluation tools. The study of Auditor and Naval (2014) suggested that physics modules should be based on the least mastered competencies, and teachers should assess the impact of the developed modules on student's knowledge acquisition. The study also recommended that in the development of the instructional

materials, these must be based on the interests, knowledge, understanding, abilities, needs and experiences of students. It is evident that instructional materials have been effective instruments for answering quality education. The developed module can be useful tool for teaching and learning science and promoted students' performance in content-knowledge acquisition.

Perez (2013) cited in her study that students must be provided with enough skills practices to develop their performance. In view of this, teachers must determine which experiences are effective in promoting learning. Various teaching method and techniques must be adequate to help students achieve their goals. Moreover, her findings revealed that supplementary interactive learning materials lesson and categorized exercises into easy, average, and difficult with interactive approach of selected areas in Mathematics IV. It equipped the learners with knowledge not only in Mathematics but also in daily activities. Ignacio (2017) mentioned that one of the indispensable requirements of effective teaching is the utilization of supplementary instructional materials that meet the needs of students and address the constraints of the teaching and learning environment. Her findings revealed that the teachers should be encouraged to design and develop instructional materials to augment the existing learner's material, innovative supplementary instructional material should align the topics and learning competencies of the K to 12 curriculum guides, discussed concepts in condensed form and simpler approach that will encourage learners and promote re-learning of least mastered skills and significantly improve the student's level of performance.

Francisco (2010) identified the CAD related technical skills and competencies that are required for employability at an entry-level position as a civil engineering technician. Civil drawings, survey maps, and topographical drawings are the most commonly prepared drawings by the respondents. Other reported drawing types include architectural, electrical/electronic, landscaping, structural, and technical illustrations. Almost all of the respondents use a CAD system for drafting functions. AutoCAD is the primary CAD platform used. Microstation is also used, but to a much lesser extent. Brown (2010) studied that the instruction of computer assisted drafting (CAD) in the high school classroom presents unique problems and challenges that typical colleges, technical schools, and industry do not have to address. Issues such as cross curriculum instruction, beginning and advanced students in the same class, several courses in the same room, CAD and manual drafting taught concurrently, shorter class periods, and limited resources.

Beagley (2011) identified the problems teachers had experienced like limited availability of suitable computers, the lack of sufficient 'hands on' time for students, and the concern for necessary security of equipment. Further, it suggested that students benefit from using CAD as they are able to do work at their own pace. Also, significant numbers of students that Technical Drawing regarded as being more challenging and more enjoyable since the introduction of CAD. Security of computer equipment is a real concern to CAD teachers, capital investment involved and the general lack of appropriate secure operating/storage facilities was viewed as constraints. Likewise, whenever practical, students should be made aware Technical of CAD, and receive some 'hands-on' experience with this form of technology. CAD teaching methods are directly student/computer workstation ratios. The utilization of a well-structured self-explanatory, self-paced tutorial when teaching CAD to access high student / computer workstation ratios and the utilization of a class lecture supplemented by a sequenced procedure handout is recommended when teaching CAD to classes with an equal student/computer workstation ratio.

Furthermore, Arslan and Dazkir (2017) indicated that the students' lack of skills in technical drawing and in creating 2D and 3D mental visualizations negatively influenced their design process. Students' lack of experience and skills cause uncertainty and prompt them to copy drawings from others and sometimes without understanding what they are

copying. Learning by copying existing examples can help students develop technical drawing skills however, students should seek help in their design and other studio courses if they struggle with understanding and mentally visualizing those examples when they are copying them.

Ozkan and Yildirim (2016) found that there was no meaningful difference between the decision-making process for choosing the drawing method and perceiving the drawing was made by the students with both methods in the first 5 minutes. The difference in quality may be due to the advantages of the CAD technique at the 30th minute. At the end of the 60th minute, a huge difference was observed between the conventional and CAD and the CAD was more successful than the conventional drafting. Consequently, the CAD technique has a better outcome from the aspect of time and quality compared to the conventional technique.

III. METHODOLOGY

Research Design

The research design involved the utilization of qualitative research methods in addressing the research questions. It was appropriate for this study because this type of methodology emphasizes looking into meanings, perspectives, experiences, and processes that are not easily quantifiable (California, 2016). By exploring the perceptions of public-school teachers who have had experiences in teaching technical drafting, it was possible to obtain “multiple perspectives” that further our understandings of providing support to effectively teach the subject. Each individual ascribes certain characteristics and attributes to any given situation. This study was designed to gain an understanding of these variations in the interpretation of teaching the subject with an end in mind of develop modules in teaching the subject.

Research Participants

Because the nature of this study requires face-to-face interaction, participants was purposely chosen. Eight (8) public secondary high school teachers who are teaching specialized subjects in Technical Drafting including Computer-Aided Drawings. Prior to the conduct of the study, the researcher already identified few informants. Purposive sampling was employed as the sampling strategy wherein samples are selected according to predetermined criteria based on the nature of the study which necessitates the rich-experiences and expertise of the Technical Drafting teachers. The identified informants are acquaintances and friends of the researchers who teach in the public schools.

Instrument

Interview guide was primarily based on the study’s research questions. Questions include their experience in CAD teacher including the challenges and supports needed by the Technical Drafting teachers. The instrument used in this study was a semi-structured interview that consists of 10 items with the opportunity for the researcher to explore particular themes or responses further. The interview allowed the researcher to identify potential source information in a manner that will bring out relevant information from its respondent. In addition to that, the researcher prepared follow-up questions that may be brought up during the interview where the participants are free to answer any response. The researcher used a recorder for the gathering of data.

Procedure

After securing permission from the school heads and principals to allow the researcher use their school and teachers as laboratory in the conduct of the fieldwork, the researcher will be starting the interview once the schedule of time and availability of the participants for a 30-

minute interview was ascertained. The researcher contacted and met each of the participants to discuss the conditions on the conduct of the interview, including the use of the recorder during the interview, the transfer and presentation of the data and the focus of the questions itself.

The researcher established first its legitimacy by showing some identification. Moreover, the researcher gained the participant's cooperation and then proceeded to the importance of the research. The interview consisted of a self-made questionnaire, having questions formulated based on the objectives of this research, ideally focusing on the experience of the participant, the encountered constraints and challenges and the needed support for them to deliver quality instruction. The researcher informed the participants that a recorder will be used for the gathering of information.

IV. RESULTS AND DISCUSSION

1. Features of Computer-Aided Drawing (CAD) for the instruction of Technical Drafting.

Since the features of CAD present set of software tools to increase productivity and efficiency in doing layouts and designs, it can be noted that the shared responses of the participants support the idea that CAD is very helpful in increasing the motivation and performance of the students in doing drafting activities since it dealt with the use of computers. Aside from that, the fact that students sometimes assumed that they are already having their profession due to the use of the equipment in CAD, it is deemed necessary that CAD has to be taught properly at their levels. Imagination of the learners in developing designs are likely to be enhance since the functions of the computer or the software makes it easy for them to manipulate everything not unlike in manual drafting that sure and accurate action has to be properly observed to avoid mistakes that will result to repetitions and dull drafting outputs. Computer-aided design becomes a useful tool in engineering and architecture work. Computers are very reliable and accurate. Professional and students should present their drawings and layout plans using computer in order to compete globally. The AutoCAD is now available in the market (Dela Cruz, 2012).

2. Common experiences of the teachers handling Computer–Aided Drawings (CAD).

From the qualitative interview relative to the experiences of the teachers teaching Computer-Aided Drawings, all respondents said that most of the printer materials used in teaching theories and concepts were downloaded from the internet. Libra and Leo mentioned that they prefer self-constructed handouts and modules so as to align it with the curriculum and to the learning styles, age and preferences of the students. The need for computer units was also stressed by Aquarius, Aries and Cancer despite having a separate question about CAD equipment on the foregoing interviews. It can also be noted that two (2) of the respondents were assessment centers for Technical Drafting, meaning, they are accredited by TESDA to serve as venue for National Competency Assessment of 10 candidates per day, however, they cannot be accredited to a training center since there is a regulation that prescribes the size of working and training areas, tools, and equipment especially, 25 computers with licensed AutoCAD software, a plotter, and a printer for 25 trainees or students.

Issues on unavailability of learning materials is obviously seen on the statements of the respondents along with issues on irrelevant content, inappropriateness to learners age and learning styles and characteristics, and misalignment with the curriculum guide and training regulations of DepEd and TESDA.

3. Challenges or constraints teachers experience in line with CAD instruction.

One of the challenges shared by Sagittarius is that she struggled on the maintenance of the classroom since it is also used by other subjects for discussion. Other than that, issues on the availability of computer units was emphasized by Libra, Aries, Taurus, Virgo, and Cancer. Challenges on teaching methodology and expertise was faced by Aquarius, Aries, and Sagittarius. The same situation experienced in the country that tantamount to the forfeited learning to the students if proper tools, teaching methods, equipment and support will not be provided. Since the program has been newly-offered to some school except those two schools offering the specialization through STVEP (Strengthen Technical – Vocational Education Program) before, they are experiencing struggles in starting the program. Most of them experienced that there a lacking classroom facilities, tools and equipment in offering the program. Generally, they found no problem in offering manual drafting since most of them said that they can easily ask the students to bring materials like paper, measuring instruments, pencils, boards and other alternatives by the teachers.

Another challenge sought by some teachers are the teaching of the basic concepts itself since it is the hardest part of the teaching of CAD. Some require their students to memorize the commands in the beginning since it will be easier along the run. The maintenance of the classroom since some school don't have definite room solely allotted for the teaching of CAD or a computer laboratory housing these computer units. Some school are still using these rooms with computer units as lecture rooms of some section which they find hard to maintain since the behavior of the students and classroom temperature might affect the condition of the computer units. Most importantly, they have seen the availability of learning modules necessary in the teaching of basic theories and concepts. Even though, they can create a module, the problem of printing the handouts and distributing it to all students is one of the problems faced by the Technical Drafting teachers. This conforms to the findings of Beagley (2011) that the teachers had experienced related mainly to the limited availability of suitable computers, the lack of sufficient 'hands on' time for students, and the concern for necessary security of equipment.

4. Support teachers need so as to deliver quality instruction in line with Computer-Aided Drawings.

From the interview, it can be noted that the support needed by the teachers may be grouped into three (3) namely, continuing enhancement program for Technical Drafting teachers, provision for computer equipment and laboratories, and availability of updated and curriculum – aligned learning modules. Participants agreed that training on the updated contents of AutoCAD is needed since these technologies are fast – changing, training to enhance their teaching expertise, and networks of teachers was seen important during the interview. It was also mentioned that there must be a connection with industries that are CAD related to easily relate the course to the students.

Sagittarius mentioned the need for networks of teachers teaching the subject so that they will be able to interact and exchange with best practices and activities that will help them deliver quality instruction as well as connection to companies that related to Technical Drafting. On the other hand, Sagittarius, Libra, and Leo agreed to have continuous training to enhance and upgrade the skills and knowledge of the teachers in teaching the subject. While seven (7) of them mentioned the need for spacious classroom that is properly ventilated and lighted, with computer units equipped with licensed software, and provision for more tools and materials. Brown (2010) agreed that the instruction of Computer-Aided Drawings (CAD) in the high school classroom present unique problems and challenges that typical colleges, technical schools, and industry do not have to address. Issues such as curriculum instruction, beginning and advanced students in the same class, several courses in the same room, CAD

and manual drafting taught concurrently, shorter class periods, and limited resources. In the same manner, security of computer equipment is a real concern to CAD teachers in respect of the essential nature of such equipment to upper school technical drawing courses; the capital investment involved and the general lack of appropriate secure operating/storage facilities. In addition, it was suggested that where possible, secure computer laboratory facilities provided with a monitored access system should be used for CAD education.

5. Proposed Instructional module in Computer – Aided Drawings (CAD).

Instructional modules provide assistance in the teachers' attainment of their learning objectives in the teaching – learning process. More specifically, these modules give reinforcement and enrichment to higher learning comprehension. Thus, geared toward quality and effective instruction, learning materials are indispensable in the teaching – learning process.

The study revealed that there is an inevitable necessity for the development of instructional modules in teaching Computer – Aided Drawings (CAD) in Technical Drafting. As this was supported with the above – mentioned facts, instructional materials played a pivotal role in the teaching of the subject and most importantly the assessment of the teacher – respondents regarding the topics that greatly need instructional materials conforms to the objective of developing a module. Specifically, topics based on the curriculum guide like basic CAD concepts, operational terminologies, CAD working environment and features, and commands. Some teachers also suggested for recommended activities to be included in the modules to make it a complete reference for the lessons.

V. CONCLUSION AND RECOMMENDATION

Conclusions

1. Features of CAD simplify and hasten the work of the users. Despite the availability of different software, user must look on the features approximating the prescribed curriculum guide of DepEd.
2. Common experiences of teachers teaching the subject are on the following: learning materials, teaching methodologies, facilities and equipment and assessment procedures.
3. Lack of facilities, teaching expertise, and availability of computer units with AutoCAD software appeared to be some of the constraints met by the teachers.
4. The supports needed by the teachers are continuous skills enhancement programs, tools and equipment, learning facilities and work spaces.
5. Modules are prepared with corresponding approved parts in order to help the teachers in teaching the subject.

Recommendations

1. The prepared modules in Technical Drafting may be tried-out for validation and evaluation before its use in the teaching of Technical Drafting
2. Technical Drafting seminars and training may be conducted to teachers to enhance their knowledge and skills.
3. A parallel study may be conducted using other areas of specializations of Technology-Vocational-Livelihood Education to validate these fields.

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