

The Implementation of Capstone Project in the Higher Education Institutions in the Region of Cagayan Valley, Philippines

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Abstract—This study was conducted to evaluate and improve the current implementation of Capstone Project in Cagayan Valley region. This study explored the profiles of support facilities, faculty qualifications, faculty composition, projects and individual guidelines. Results were then compared against the requirements of the Commission on Higher Education's (CHED) promulgated policies and standards for IT education and recommended guidelines of Philippine Society of IT Educators (PSITE). Results of the study indicated that facilities, faculty qualifications and faculty compositions satisfy the standards of IT Education while individual guidelines mostly conform to the recommended guidelines. Also, majority of projects are software development while scopes are mostly personal and local area network. The study concluded that CHED's vision of producing competent graduates that will cater to the needs of the industry can be attained only if HEIs will exercise a culture of excellence in their individual implementation of capstone project.

Index Terms—Evaluation, Cagayan Valley, capstone project, HEI, higher education institutions, implementation, IT Education, Philippines.

I. INTRODUCTION

The Commission on Higher Education (CHED) recognizes the rapid advancement and development in the field of Information Technology (IT); and its evolvement as a continuous process. In order to face this challenge, the commission recognizes the need to be responsive to the current needs of the country hence, it is essential and important that the country's IT capability be continually developed and strengthened to be at par globally. For this purpose, the commission promulgated the "Policies and Standards for IT Education" detailing the minimum requirements for Higher Educational Institutions (HEIs) offering or intending to offer quality Information Technology Education (ITE) Programs. It was developed with consultation from all stakeholders; from the academe to the industry. In order to ensure the effectiveness of this policy, students who will take the program are required to undertake a Capstone Project during their senior year. This requirement enforces the student to exhibit his competency in software development in the form of systems application or enterprise resource plan [1]. The promulgated policies and standards,

however, did not provide any framework or guideline that can be used by HEIs to undertake capstone project.

The Philippine Society of Information Technology Educators (PSITE), a professional ITE organization, developed and circulated a guideline entitled "Recommended Guidelines for Undergrad Theses/ Capstone Projects in IT Education". This guideline details all the necessary requirements and procedures to undertake capstone project. The guidelines were developed based on the promulgated CHED Policies and Standards for ITE Programs, ACM Computing Curricula 2005 and NCITE pre-conference presentations [2]. The PSITE guideline however, is not enforced as a policy to be complied with by the HEIs but a guideline to be voluntarily accepted and implemented.

The objective of the promulgated policies and standards for ITE Program is to rationalize IT Education and keep pace with the demands of global competitiveness. The lack of guideline to undertake capstone project subjected HEIs to develop or adopt one for their own use. The diversity of guidelines used also leads to diverse level of measurements for student competencies from which capstone project is used to showcase and prove that their abilities are worthy of earning the degree [3].

This study was conducted to evaluate the implementation of Capstone project in the region of Cagayan Valley for its continuous improvement and to close gaps between individual guidelines [4], [5]. This study explores the compliance of HEIs to the promulgated policies and standards for ITE Programs, determine the guidelines used by HEIs then compare it against the PSITE recommended guidelines and lastly, determine the scope of projects then compare it against current standard.

II. LITERATURE REVIEW

A. Policies and Standards for ITE Programs

The promulgated policies and standards specifies requirements relevant to the undertaking of Capstone Project that include but not limited to faculty qualification, faculty composition and IT support facilities needed by students. It also specifies a specific form for the capstone project to be taken.

Capstone project is a mandatory requirement and can be taken in the form of a software application or enterprise resource plan. A software application is a program or group of programs designed for end users. It can be a systems software or applications software. An enterprise resource

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plan on the other hand is an application software that integrates departments and functions across a company into one computer system. The latter has a very high level of complexity and often avoided because of high level of failure due to limitations of time and financial resources [6]. For the study, the project areas under the PSITE recommended guidelines will be used instead to classify the projects as it offers a more defined classification of projects.

Faculty composition requires that 20% of the faculty should have an industry experience in the last five (5) years. Industry experience specifies engagement in IT Profession such as technical administration, systems design, applications programming or equivalent. It also requires that 30% of the faculty must have completed at least a master's degree.

Faculty qualification requires that an ITE Faculty should have a degree in ITE in any level or an allied program but with some additional requirements.

Support facilities require, among other things, that initially HEIs should have two (2) computer laboratories with 15 units of personal computers, a printer and a LAN connection for each Laboratory. The recommended total number of personal computers should be equal to 10% of the total number of students in the program. An internet connection is also required and 30% of the hardware and software should have been acquired in the last three (3) years. Hardware and software requirements will be merged together with network scopes and presented in a single table combining the three.

This study explored each requirement not for verification purposes but rather to find-out the extent of compliance beyond the minimum requirements.

B. Recommended Guidelines for Undergraduate Capstone Project

Adviser/Panel Composition requires that a project is prepared under the guidance of an adviser and must be presented and accepted by a Panel composed of at least 3 members that includes the adviser. The adviser must have completed an IT/IS project successfully beyond the bachelor's degree project and should be a full-time faculty member otherwise a full-time faculty co-adviser is required. Advisers and Panel Members should have a degree in an ITE or allied program, at least one of the panel members must have a master's degree in ITE (preferably IT or IS) or allied program and at least one must have an industry experience. As a general rule, faculty advisers should handle at most five projects. Duration requires that Capstone Project duration should be one (1) or two (2) semesters. Team composition requires that each project be taken by an individual or team of two to five members depending on the complexity of the project. A public presentation is recommended (School-based presentation open to the public). Suggested project areas include software development (software customization, information systems development for an actual client with pilot testing, web applications development with at least alpha testing on live servers, mobile computing systems); multimedia systems (game development, e-learning systems, interactive systems, information kiosks); and Network design & implementation (server farm configuration & management; IT management; IT strategic plan for sufficiently complex enterprise; and IT security analysis, planning and implementation) [7]. A specific manuscript template is also recommended.

This study evaluated each guideline used by HEIs and compared against these requirements and noted differences and exceptions. The purpose is, again, not to verify compliance because HEIs need not to but rather to discover common practices that are potential improvements in developing a standard guideline.

C. Network Scope of Projects

The recommended guidelines for undergraduate Capstone Project suggest four project areas that students can choose from. However, there was no specific network scope requirement for any project so a student can choose to undertake any form of project even as simple as a stand-alone system which may defeat the policy and standards' rationale that the country's IT capability be at par globally [1]. The objective of including network scope is to assess the integration of current standards in ICT and make improvement on the course to keep up with current technologies [8], [9]. It is important that students exhibit technical competency on the utilization of current standards in ICT infrastructures to demonstrate competitive IT capabilities [3], [10].

This study uses five network scopes to classify the projects of students. Each scope is characterized by the geographic area they span or physical size [11]. These scopes are personal, local, metro-wide, wide and GSM mobile networks. GSM mobile network is added to survey if there are HEIs in the region that ventured in using emerging ICT technologies specifically SMS [8], [12].

Personal area network (PAN) is a computer network organized around an individual person. This classification involves a mobile computer, a cell phone and/or a handheld computing device linked by cables or wirelessly. Universal Serial Bus (USB) and FireWire technologies often link together a wired PAN while wireless PANs typically use Bluetooth or sometimes infrared connections. Generally, it covers a range of less than 10 meters [13].

Local area network (LAN) supplies networking capability to a group of computers in close proximity such as in an office building, a school, or a home [14]. Metropolitan area network (MAN) covers a larger geographical area ranging from several blocks of buildings to entire cities. It provides means for internetworking of LANs. Metropolitan Area Networks can span up to 50 km [15]. Wide Area Network (WAN) is a geographically-dispersed collection of LANs that spans a country or a continent; the Internet is the largest WAN that spans across the globe [16]. Almost 33% of world population is connected to the Internet. Global System for Mobile Network (GSM) is an open, digital cellular technology used for transmitting mobile voice and data services. Terrestrial GSM networks now cover more than 90% of the world's population. This study explored the network scopes of projects to find out if students were utilizing current standards in ICT infrastructures.

III. METHODOLOGY

Validated researcher-made questionnaires and interview (mostly thru the aid of [1] and [2] while the rest were based on [8-12]) were used to gather the required data for the study. Respondents for the study include 23 IT program

supervising officers, 140 faculty members and 272 students. Total enumeration was used for the supervising officers while random sampling was used for the students and faculty members. The sample was proportionally distributed among the 23 participating institutions in the region. The questionnaire for the students was used to gather data about their group size, project area used, network scope of the project and relevant problems encountered during the course of developing the project. The questionnaire for the faculty members was used to gather data about their role in Capstone Project, highest education attainment, course, industry experience and problems they have encountered while performing their duties in capstone project. The interview conducted to supervising officers was used to gather data about the available IT support facilities of HEIs and the individual guidelines used to implement capstone project.

IV. RESULTS

A. Requirements under CHED Policies and Standards

To attain the commission’s vision of producing competent graduates that shall cater to the needs of the industry, it is necessary that students taking-up IT program are trained by capable faculty members with complete support facilities. This combination should properly prepare students to become competent IT professionals.

TABLE I: FACULTY INDUSTRY EXPERIENCE

Industry Experience	Frequency	Percentage (%)
With industry experience	86	61.43
No industry experience	54	38.57
TOTAL	140	100.00

TABLE II: HIGHEST EDUCATIONAL ATTAINMENT

Level of Education	Frequency	Percentage (%)
College degree holders	1	0.71
With on-going masteral studies	57	40.71
Masters’ degree holders	64	45.71
With on-going doctoral studies	13	9.29
doctorate degree holder	5	3.57
TOTAL	140	100.00

TABLE III: FACULTY COURSE

course	Frequency	Percentage (%)
ITE	117	83.57
Allied Course	18	12.86
Others (Non-ITE)	5	3.57
TOTAL	140	100.00

Findings show that HEIs satisfies faculty qualifications and composition beyond what is minimally required. The number of faculty member respondents with industry experience surpasses the 20% requirement by up to more than three times; the combined number of faculty members with at least a masters’ degree surpasses the 30% faculty composition requirement by almost two times; and almost all faculty members have an ITE or allied degree that complies with the faculty degree requirements of an IT Program. These findings also satisfy the panel composition under the recommended guidelines of PSITE which requires that at least one member

have a master’s degree in ITE or allied program and at least one member with industry experience. The findings also indicate that HEIs show high regard over the quality of faculty line-up which is necessary for quality instructional delivery. This finding implies that students who are taking-up IT program were trained by capable mentors.

TABLE IV: AVAILABILITY OF IT SUPPORT FACILITIES

Scope	Frequency	Percentage (%)
Personal Area Network	23	100.00
Local Area Network	23	100.00
Metro-wide Area Network	15	65.22
Wide Area Network	23	100.00
GSM Network	4	17.39

HEIs complied with the minimum requirements for support facilities including current ICT infrastructures while a few already took the initiative to include emerging ICT Infrastructure. This finding shows that HEIs also have high regards for the completeness of support facilities. This finding implies that students who are taking-up IT program have the necessary facilities needed in their training to become a capable IT professional. Both findings show that HEIs have the line-up of capable faculty members and the necessary support facilities needed to mould students into competent IT professionals. The competency of students derived from capable faculty members combined with complete set of support facilities are expected to be exhibited during the undertaking of capstone project.

B. Requirements under PSITE Recommended Guidelines

The process of developing a capstone project is governed by the individual guidelines used by HEIs. These guidelines cover the development of a project from conception to presentation and its evaluation by a team of panel whose qualification and composition is also specified by these guidelines. Individual guidelines were explored and compared against the recommended guidelines of PSITE to establish any similarities and discrepancies.

TABLE V: ADVISER/PANEL COMPOSITION

Recommended Guidelines	Frequency	Percentage(%)
Capstone Projects (CP) are prepared under the guidance of a group adviser	15	65.22
CPs are presented and accepted by a panel	23	100.00
At least 3 panel members	23	100.00
Adviser serve also as panel member during defense	6	26.09
Advisers are fulltime faculty members	23	100.00
have completed an IT project beyond degree requirement	9	39.13
All advisers have a degree in ITE or allied programs	21	91.30
The panel include at least one member with a master's degree in ITE or allied program and at least one member with an industry experience	22	95.65
Advisers handles 5 CPs at most	13	56.52
Clients of actual software development is represented during project presentation	11	47.83

Capstone project is normally handled by a class adviser, however results indicate that capstone project is prepared under the guidance of a group adviser in majority of HEIs. Results also indicate that faculty members serving as advisers have qualifications that conform to the recommended guidelines except for the completion of an IT project beyond the degree requirement and that they are not allowed to sit down as a panel during defense of their advisees. Panel qualification and composition of HEIs fully conforms to the recommended guidelines. This finding implies that majority of HEIs show concern over successful project development by providing group advisers to personally guide students whereas the team of panel in charge of evaluation has the necessary qualification and composition to make a sound discretion in accepting or rejecting a project.

TABLE VI: DURATION/TEAM COMPOSITION/PRESENTATION

Recommended Guidelines	Frequency	Percentage (%)
CPs are prepared in 1-2 Semesters	22	95.65
Maximum of 5 students in a group	23	100.00
CPs are presented in a forum, at least school based and open to public	7	30.43

TABLE VII: PROJECT AREAS

Suggested Areas	Frequency	Percentage (%)
Software development	23	100.00
Multi-media systems	23	100.00
Network design & implementation	22	95.65
Manuscript is PSITE recommended format	4	17.39
based on the recommended format	7	30.43

Results indicate that capstone projects are prepared by an individual or a group with a maximum of five members in one to two semesters. Results also indicate that HEIs are using the same areas suggested by PSITE however the recommended manuscript format is not followed and forum presentation is generally not conducted. This finding implies that HEIs are more concerned in project preparation than post-presentation which literally means that the interest of HEIs in capstone project declines right after panel presentation.

TABLE VIII: OTHER PRACTICES

Practices	Frequency	Percentage (%)
Defense fee is free	12	52.17
Students are allowed to hire domain experts	19	82.61
Students are allowed to hire editor for their manuscript	23	100.00
Students are allowed to hire advisers other than the assigned adviser	16	69.57

Results indicate that majority of HEIs allow their students to hire a domain expert, a manuscript editor and even a second adviser for their project. Results also indicate that financial obligation is not a requirement in majority of HEIs. This finding implies that students have the freedom to obtain personal support for their project which eliminates most reasons not to pass capstone project.

C. Classification, Network Scope and Group Size

The attributes of a project demonstrates the technical competency of students in IT. Group size shows the complexity of projects as it is the criteria used to determine

their number. The project area shows the student's area of preference whereas the scope shows their capability to utilize which communication technology.

TABLE IX: PROJECT AREAS USED

Areas	Frequency	Percentage (%)
Software Development	218	80.15
Multi-Media	50	18.38
Network Design and Implementation	4	1.47
TOTAL	272	100.00

Results of the study indicate that majority of students prefer software development in their projects than any other area. This finding implies that the region is satisfying the need of industry for software developers and some for multi-media developers but does not satisfy the need of industry for network specialist.

TABLE X: NETWORK SCOPE OF PROJECTS

Scopes	Frequency	Percentage (%)
Personal Area Network	109	40.07
Local Area Network	101	37.13
Metro-wide Area Network	1	0.37
Wide Area Network	53	19.49
GSM Mobile Network	8	2.94
TOTAL	272	100.00

Results of the study indicate that most students have the capability to utilize ICT for PAN and LAN scopes only. This finding implies that the region is mostly satisfying the need of the industry for IT professionals that are capable of using ICT for PAN and LAN scopes. Some can satisfy the need of the industry for IT professionals that are capable of using ICT for WAN but the region is yet to satisfy the need of the industry for IT professionals that are capable of using MAN and GSM mobile network.

TABLE XI: STUDENT GROUP SIZE

Size	Frequency	Percentage (%)
1	10	3.68
2	37	13.60
3	154	56.62
4	34	12.50
5	27	9.93
6 and above	10	3.67
TOTAL	272	100.00

Results of the study indicate that majority of projects were undertaken by a group of three (3) students which is within the recommended number. This finding should imply that majority of projects have medium complexity however, the interpretation of system complexity may vary from school to school due to the absence of standard reference.

D. Problems Encountered in Capstone Project

TABLE XII: PROBLEMS ENCOUNTERED BY FACULTY MEMBERS

Problems	Frequency	Percentage (%)
No representative from the industry during capstone project defense.	73	52.14

Only one major problem appeared in the survey which is the lack of industry representative during defense which may explain the findings in Table V. The rest of the problems noted were below 50% and were not shown in table. This

finding implies that the limited participation of the industry results in limited input which is critical in the continuous development of institutional standards for capstone project specifically they can pin-point the skills that are needed for industrial environment [17], [18]. Also their inputs are very necessary in increasing the accuracy of academically prepared projects for industrial use.

V. CONCLUSION

Over-all results of the study indicate that the faculty members are capable in instructional delivery with all the necessary support facilities from PAN to WAN which generally covers all scopes commonly used by the industry. Students are also given group advisers to personally guide them in undertaking capstone project and they have the option to obtain personal support from other experts. With all these perks, expectations are high and reasons for any student not to become a capable IT professional are slim. On the other hand, the attributes of projects submitted by students are below expectations and that generally, results show limited student competency in WAN which is today's standard in communication.

Capstone project serves as an institutional assessment for students taking up the course to determine if they are worthy of earning the degree. Findings on submitted projects indicate the exploitation of personal and local area network scopes that allows students to undertake capstone project without the need to exhibit technical competency on current ICT technologies that can defeat CHED's rationale on the policies and standards for ITE program which is the development of the country's IT capability to be at par globally.

This study concluded that the commission's vision of producing competent graduates that will cater to the need of the industry can only be attained if the HEIs will exercise a culture of excellence in the implementation of capstone project. Therefore, the need for continuous improvement on its implementation is very essential.

CHED, PSITE and the HEIs should collaborate to draft the minimum guidelines for capstone project that will guarantee the realization of the commission's vision. The minimum guidelines should discourage HEIs from underperforming but should also give them the freedom to exercise a culture of excellence in the implementation of capstone project.

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