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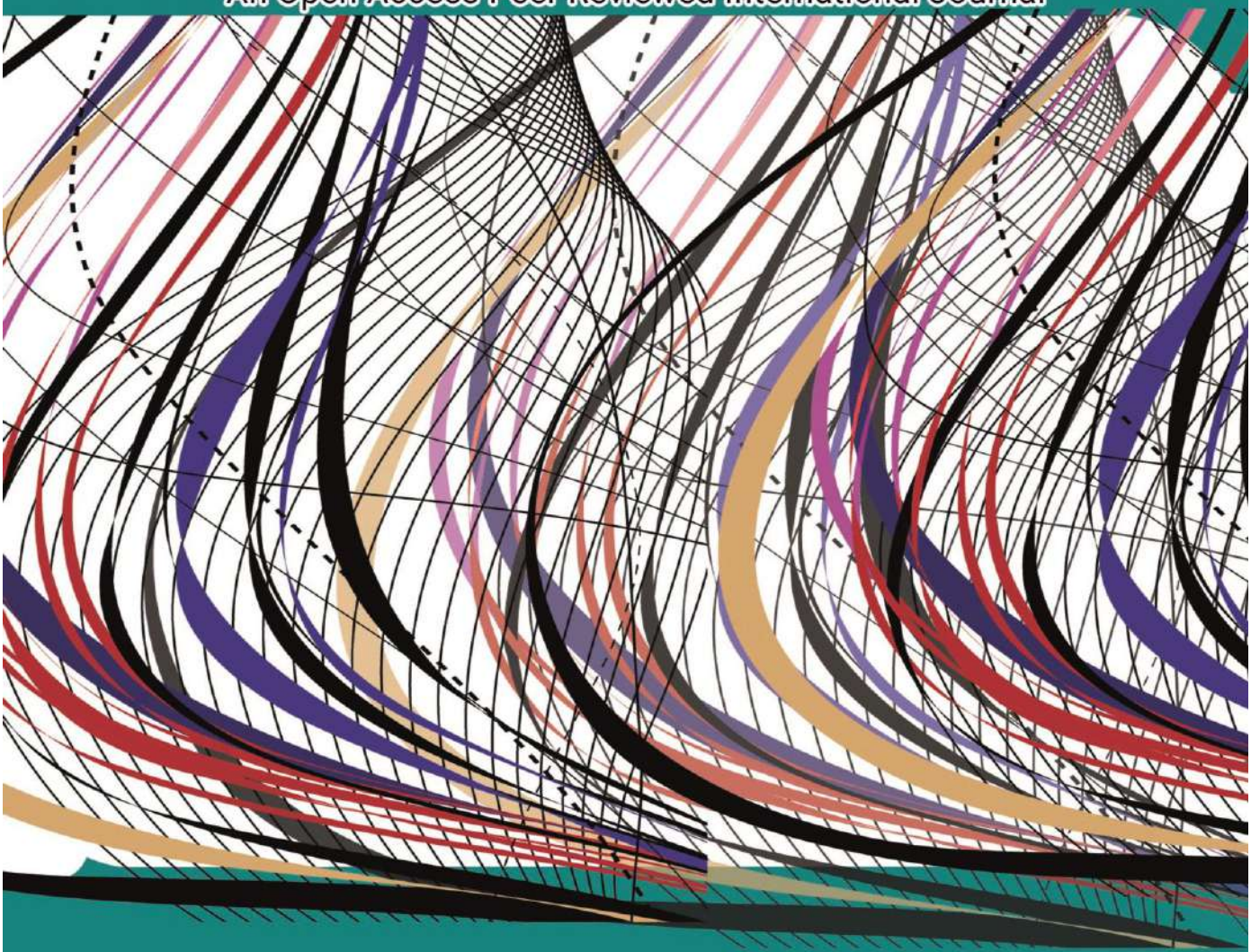

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FOREWORD

I am pleased to put into the hands of readers Volume-6; Issue-1: Jan, 2020 of **"International Journal of Advanced Engineering, Management and Science (IJAEMS) (ISSN: 2354-1311)" ,** an international journal which publishes peer reviewed quality research papers on a wide variety of topics related to Science, Technology, Management and Humanities. Looking to the keen interest shown by the authors and readers, the editorial board has decided to release print issue also, but this decision the journal issue will be available in various library also in print and online version. This will motivate authors for quick publication of their research papers. Even with these changes our objective remains the same, that is, to encourage young researchers and academicians to think innovatively and share their research findings with others for the betterment of mankind. This journal has DOI (Digital Object Identifier) also, this will improve citation of research papers.

I thank all the authors of the research papers for contributing their scholarly articles. Despite many challenges, the entire editorial board has worked tirelessly and helped me to bring out this issue of the journal well in time. They all deserve my heartfelt thanks.

Finally, I hope the readers will make good use of this valuable research material and continue to contribute their research finding for publication in this journal. Constructive comments and suggestions from our readers are welcome for further improvement of the quality and usefulness of the journal.

With warm regards.

Dr. Dinh Tran Ngoc Huy
Editor-in-Chief
Date: Feb, 2020

Editorial Board/ Reviewer Board

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Development of Indonesian National Qualification Framework-Based teaching models and materials for learning instructional media design Department of building Engineering education faculty of engineering state University of Medan

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Abstract— *The learning model developed in this study is a whole series of presentation of teaching material that covers all aspects before being and after learning conducted by lecturers by including teaching materials in the teaching and learning process. The learning model developed is called QI MODELS with the syntax: Goals, Observation, Project, Discussion, Task, Practice, Meaningful, Justification, and Evaluation. Teaching material contains a set of material from the course "Instructional Media Design" that is arranged systematically so that lecturers and students can use it in the learning process in an atmosphere and a comfortable environment for learning.*

To see the effectiveness of the product an analysis of the learning outcomes of the 26 students taught using the Instructional Media Design textbook developed, and compared with the learning outcomes of students in the class taught with presentation material. Based on the analysis, the average value of basic competencies using instructional materials for Indonesian National Qualification Framework (INQF)-based Instructional Media Design is higher than the average value of students who use presentation materials. Testing the hypothesis used is a different test. From the calculation results obtained $t_{count} = 7.63$ *while* $t_{table} = 2.01$*. Because* $t_{count} = 7.63 > t_{table} = 2.01$*, it was concluded that there was a significant difference in students' learning achievement using Instructional Media Design textbooks and using presentation material. The effectiveness of the use of Instructional Media Design textbooks is 79.09%.*

Keywords— ***Learning Model, Indonesian National Qualification Framework, Teaching Materials.***

I. INTRODUCTION

In fact, giving direct experience to students is not something easy, because not all experiences can be directly learned by students. For example, if you want to explain the conditions on the surface of the moon, then it is not possible that the experience is gained directly by students. important in a teaching and learning activity.

Implementation is a process of applying ideas, concepts, policies, or innovations in the form of practical actions so as to have an impact, both in the form of changes in knowledge, skills, and values and attitudes. The implementation of the curriculum can be interpreted as actualizing the written curriculum in the formlearning, according to what Miller and Seller (1985) disclosed: "In some cases, implementation has been identified with instruction". The implementation of the curriculum is an attempt to transfer curriculum planning into operational action. In other words the implementation of the curriculum is an application, ideas, concepts, programs, or order of the curriculum into learning practices or various new activities, so that changes are expected.

Some of the results of research conducted over the last two decades have provided evidence of the impact of technology on student performance and the learning

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environment. Cotton (1991), for example, has conducted a study of 59 research results regarding computer-assisted learning and learning outcomes. Studies that focus on technology are apparently better than studies that discuss the impact of technology on the overall learning environment and student learning outcomes. The findings of this study also showed that researchers who tried to find answers directly to student learning problems, the results were not satisfactory. However, lecturers who understand the complexity of learning and teaching, the results of the research show encouraging things and show that new technology has proven to be effective. In addition, technology has shown a very positive impact based on research studies. Innovative learning techniques (for example, question techniques included in texts, advance organizers, and media) specifically show the average progress of learning outcomes for students by 15.20 points or more. This means that the average student score reaches the 50th percentile in conventional learning, and the 65th percentile in groups that are learned with technology (Heinich, Molenda, Russel, & Smaldino, 2002).

Virvou, Katsionis and Manos (2005) in their research results entitled "Combining software games with education: evaluation of its educational effectiveness" with the evaluation results showing that virtual games in learning are very motivating and have an effect on improving student learning outcomes. "Some extensions for the current contextualised media were given on the basis of a reference model that was the result of earlier research in the field" (De Jong, Specth, & Koper, 2008).

II. DEVELOPMENT OF MODELS AND TEACHING MATERIALS BASED ON THE INDONESIAN NATIONAL QUALIFICATION FRAMEWORK

INQF is regulated in Presidential Regulation No. 8/2012. INQF is an embodiment of the quality and identity of the Indonesian people in relation to the national education system, the national work training system and the national equality assessment system, which is owned by Indonesia to produce human resources from learning achievements, which are owned every Indonesian worker in creating quality work and contributing in their respective fields of work.

The basic principle developed in INQF is to assess a person's performance in scientific aspects, expertise and skills in accordance with the learning outcomes obtained through the process of education, training or experience that has been exceeded, which is equivalent to the qualification descriptors for a certain level. INQF implementation is expected to: (a) improve the quality of national education and training; (b) increase the recognition of the international community on the results of national education and training; (c) increase recognition of non-formal and informal education outcomes by the formal education system; and (d) increasing stakeholder confidence in the quality and relevance of the workforce generated by the national education and training system.

INQF contains descriptors that explain the ability in the field of work, the scope of work based on knowledge that is mastered and manjerial ability. A description of the parameters forming each of the IQF descriptors is as follows: a. Ability in the field of work. This component describes the ability of someone who is in accordance with the relevant work field, is able to use methods / methods that are appropriate and achieve results with the appropriate quality level and understand the conditions or standards of the process of carrying out the work. b. The scope of work is based on the knowledge that is mastered, it is intended that the qualifier descriptor must explain the scientific branch that is controlled by someone and be able to demonstrate the ability based on the branch of knowledge that he masters. c. Managerial ability, shows that the qualification descriptor must explain the scope of a person's responsibilities and the standard of attitude he has to carry out the work under his responsibility.

III. DEVELOPMENT OF LEARNING MODELS

The model as explained by Richey (1986) is a picture that arises from the fact that it has an arrangement of a certain order. According to him, the model can be used to organize knowledge from various sources and then be used as a stimulus to develop hypotheses and build theories into concrete terms / conditions to apply them to practice or test theories. Gustafson (1984) which emphasizes the practical function of the model: means to facilitate communication, or regular instructions (algorithms) that are prescriptive in order to make decisions, or planning instructions for management activities. Furthermore, Nadler (1988) explained that a good model is a model that can help the user to understand what the overall process is fundamentally. (Arends, 1997: 7); Joyce (1992: 4) The development of learning models is strongly influenced by the nature of the material to be taught, also influenced by the objectives to be achieved in the teaching and the level of student ability. In addition, the development of learning models always has stages (syntax). There is a difference between one syntax and the other, the difference mainly takes place between the opening and closing of learning, which must be understood by the closing lecturer of learning, so that these models can be implemented successfully. Learning Model Components: a. Syntax, b.

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Reaction Principle, c. Social System, d. Support System: Syntax of steps, phases, or sequence of learning activities. So the syntax is the description of the model in action. Each model has a different syntax or model structure; Principle of Reaction is the lecturer's reaction to student activities. In the example of Model B, maybe during phase II (two) the lecturer gives an example of how to construct concepts, and students compare their concepts.

The connection with learning models of learning serves to direct us to design learning that is used as a guide in organizing learning in order to achieve effective, efficient, attractive, and humanistic learning. Joice (1992) explains the learning model is a plan or a pattern that is used as a guide in planning learning in class or learning in tutorials and to determine learning tools and direct us in designing learning to help students so that learning objectives are achieved.

IV. LEARNING MEDIA AND TEACHING MATERIALS

Lecturers as good learning managers in the learning process must certainly have high creativity in managing their class, one of which is in terms of the selection and use of media and learning resources for the benefit of the learning process. The media literally means "intermediary" or "introduction". AECT (Association for Educational Communication and Technology) defines media as all forms used for the process of channeling information. Robert Hanick and colleagues (1986) define media as something that carries information between the source and receiver of information. Still in the same angle Kemp and Dayton put forward the role of media in the communication process as a style of sender (transfer) which transmits messages from the sender (sender) to the recipient of the message or information (receiver). Latuheru (1993) explained that learning media is a learning aid that is based on a curriculum that is tailored to the competencies that must be achieved by students. Learning media are used to channel or convey messages with educational and learning goals. Learning media are materials, tools, or methods or techniques used in teaching and learning activities, with the intention that the process of educative communication information between educators and students can take place in an effective and efficient manner. Rudy Bretz in Sadiman (2014) divides the media into three main elements, namely sound, visual and motion. Bretz also classified the media into 8 (eight) types namely motion visual audio media, silent audio visual media, semi-motion audio media, motion visual media, silent visual media, semi-motion media, audio media and print media. The practical benefits of learning media are that learning media can clarify the presentation of messages / information, facilitate and improve the process and learning outcomes, increase and direct student attention, increase learning motivation, and learning media can overcome the limitations of the senses, space and time.

V. DEVELOPMENT RESEARCH APPROACH

This research approach uses the Borg & Gall (1983) development model combined with Dick & Carey's learning design model (2009). In accordance with the Research and Development approach model, the implementation of this research follows the steps: a preliminary survey, design of the textbook model, testing of the textbook model, validation of the textbook and dissemination. This research was conducted at the Department of Building Engineering Education Faculty of Engineering Unimed in 2019. The flow of model development can be explained as fig-1.

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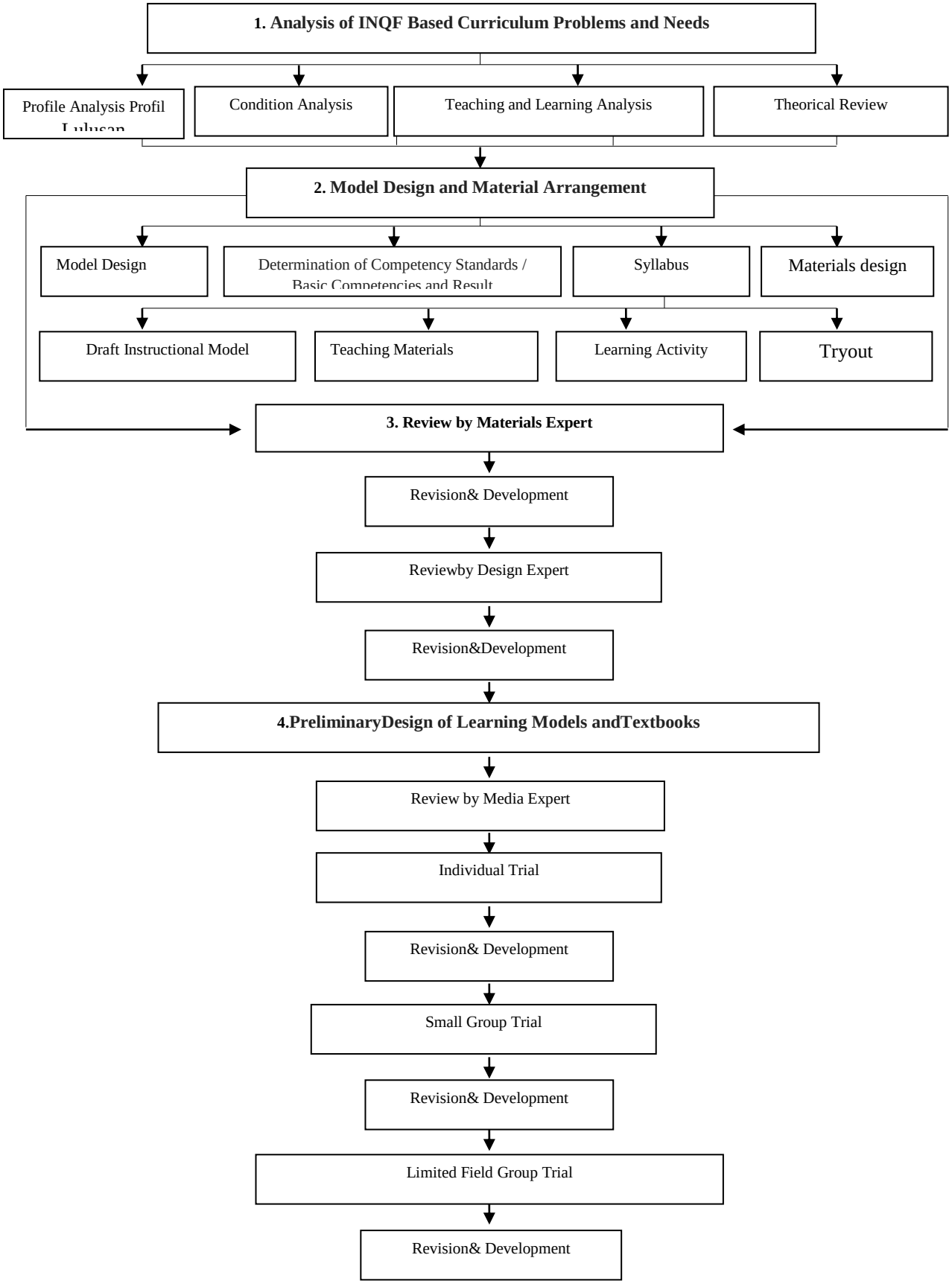

Fig.1. Flow of Development and Research Learning Model Based on INQF

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VI. RESULTS OF INQF-BASED LEARNING MODEL DEVELOPMENT

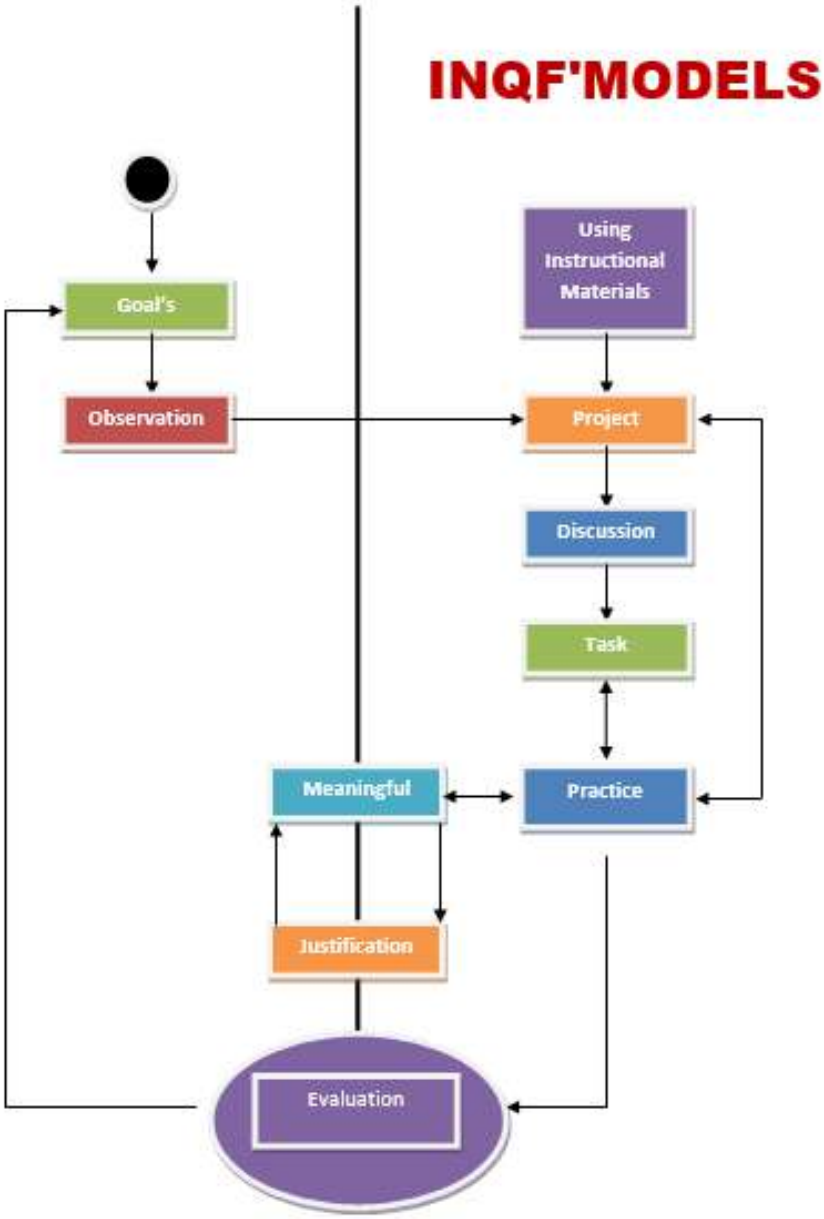

Fig.2: INQF-Based Instructional Model

LEARNING STEPS OF INQF'MODELS

STEPS 1:	**PRELIMINARY ACTIVITIES :**
GOALS	1. explain the graduate profile, objectives and competencies to be achieved both general and supporting competencies. 2. mention the facilities or supporting tools needed. 3. Form small groups and motivate students to engage in selected learning activities.
STEPS 2:	**CORE ACTIVITIES :**
OBSERVATION	1. shows learning media to be observed by students related to learning topics 2. helping students define and organize observations related to the project to be worked on (setting

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	topics, assignments, schedules, etc.) 3. encouraging students to gather information through observation to get explanations, data collection, hypotheses, and problem solving.
PROJECT	1. explain the form of projects to be undertaken by students 2. motivating students to engage in project work activities. 3. assist students in planning / preparing appropriate work such as reports and helping them share assignments with their friends. 4. analyzing projects assisted with teaching materials
DISCUSSION	1. students share assignments with their friends to reflect on or evaluate experiments and the processes they use. 2. students discuss the form of assignments according to the project bill that will be done
TASK	1. explain the work bills according to the assignments to be carried out by students 2. explain the procedures for carrying out the task in doing the work / project. 3. students make work agreements in the implementation of the task.
PRACTICE	1. students compile the task implementation procedures in doing the work / project. 2. students carry out assignments for project completion
MEANINGFUL	Re-explore the procedures for carrying out the tasks in doing the work / project. Helping students understand about projects that are done with their friends Students reflect or evaluate the work they use. Students prove the hypothesis Students compile reports
JUSTIFICATION	1. Showing back the work of students 2. Add basic knowledge about the advantages and limitations of the project that is done by students. 3. Correcting reports prepared by a number of students in the class.
STEPS 3:	CLOSING ACTIVITIES
EVALUATION	1. Discuss the results of observations and answer the questions on the activity sheet based on observation data and related concepts in the source book, recording all the answers to the existing questions. 2. Provide an explanation of the questions raised by students 3. Provide conclusions 4. Students are reminded to refine the report on the results of group work on answers to questions that have been formulated to be given an assessment.

VII. EFFECTIVENESS OF THE LEARNING MODEL

Learning design experts assess the developed Instructional Media Design textbooks have a feasibility with the percentage of assessment on the feasibility aspects of the presentation with an average score of 84.69%. This means that Instructional Media Design textbooks that have been developed can meet the demands of learning needs seen from the assessment indicators of presentation techniques, supporting presentation, presentation of learning, and the coherence and ruttering of the criterion flow line is very good.

Learning media experts assess the textbook of Instructional Media Design of the Department of Building Engineering Education Faculty of Engineering Unimed that was developed already has a feasibility with a percentage assessment of the feasibility component of graphic with an average score of 86.00%. This means that the Instructional Media Design textbooks that have been developed can meet the demands of learning needs.

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The results of the expert material assessment of the Instructional Media Design textbooks show an average percentage of 78.42% including a good category, which means the presentation of the material in the Instructional Media Design textbooks is very good on aspects of content eligibility, language aspects, and contextual material and can be used in the learning process of the Department of Building Engineering Education Faculty of Engineering Unimed.

The results of giving pretest to students who were taught using the Instructional Media Design textbook obtained the lowest value of 30.58, the highest value of 58.37, an average value of 45.28 and a standard deviation of 7.12. The results of giving posttests to students who were taught using the Instructional Media Design textbooks obtained the lowest value of 65.35, the highest value of 89.75, an average value of 79.35 and a standard deviation of 5.75. The results of giving pretest to students who were taught using presentation materials obtained the lowest value of 35.72, the highest value of 59.63, the average value of 47.24 and the standard deviation of 5.27. Then the results of giving posttest to students who were taught using presentation materials obtained the lowest value of 58.27, the highest value of 79.95, the average value of 67.27 and the standard deviation of 5.67.

Testing the hypothesis used is a different test. From the calculation results obtained tcount = 7.63 while ttable = 2.01. Because tcount = 7.63>ttable = 2.01, it was concluded that there was a significant difference in students' learning achievement using Instructional Media Design textbooks and using presentation material.

VIII. DEVELOPMENT

Research and development is carried out with the aim of producing products in the form of textbooks based on contextual learning as well as testing the effectiveness of products that can be utilized by Unimed Department of Building Engineering students as one of the strategies to improve the quality of learning and learning outcomes. Therefore the research process and this development is carried out and begins with several stages including (1) conducting a preliminary study including observation, interview and literature study. From the observations, it was obtained that students really need teaching materials in the form of Instructional Media Design textbooks that fit the characteristics of students. (2) designing a product to produce an initial product of Instructional Media Design textbooks, these activities include: a) conducting preliminary research which includes identifying needs and learning objectives, determining core competencies, mapping basic competencies, mapping indicators; b) conduct a learning analysis by determining the more specific skills that must be learned; c) identify the characteristics and initial behavior of students; d) write down basic competencies and indicators; e) compile a benchmark reference test by developing assessment points to measure students' abilities that are estimated within the learning objectives; and f) developing learning strategies. (3) Developing Instructional Media Design textbooks. These activities include: introduction, SK, KD and indicators of learning outcomes, learning activities and bibliography. (4) The design of learning activities include: learning materials, summaries, tests, and answer keys. (5) formative evaluation and revision, this activity includes product evaluation to determine the strengths, weaknesses and weaknesses regarding the quality of content and design carried out by material, design and media experts. From the results of the evaluation will be used as material for product revisions. This is consistent with the steps developed by Borg and Gall (1983) ,; and (Dick & Carry, 2009).

The results of the next revision were tested to students through trials of individuals, small groups, and limited fields. This trial is expected to get feedback to produce Instructional Media Design textbooks that are appropriate to be used in accordance with the characteristics of students as users. After going through a series of trials and getting feedback from students as users, a revision was made based on expert advice and input to produce aInstructional Media Design textbook product that is feasible to use. From the overall validation data the respondents obtained a value with very good criteria. This illustrates that the trial procedure is carried out to adjust the design of the model with the learning needs in the classroom that allow the learning process to be oriented to students and in accordance with the demands of the IQF.

To see the effectiveness of the product an analysis of the learning outcomes of the 26 students taught using the Instructional Media Design textbook developed, and compared with the learning outcomes of students in the class taught with presentation material. Based on the analysis, the average value of basic competencies using the Instructional Media Design textbook based on INQF is higher than the average value of students who use presentation material. So it can be stated that there are differences in learning outcomes between classes using textbooks based on INQF-based Instructional Media Design on learning outcomes using presentation materials. Thus the learning model that is accompanied by INQF-based teaching materials can be used in learning effectively and efficiently.

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Textbooks for Instructional Media Design based on Student Center Learning offer learning that has strong potential to improve the quality of learning and student activity. The material presented in the Instructional Media Design textbook is based on Bruner's learning theory and learning events according to Gagne. Bruner's theory is used as a principle of material presentation, which starts from the easy thing in a stepwise direction towards more complex matter. In the Instructional Media Design textbook, this presentation is shown in the formulation of indicators that start from the easy to the difficult. The formulation of indicators as well as being a reference presents the content of Instructional Media Design textbooks. The level of effectiveness of Instructional Media Design textbooks to improve learning outcomes is high, this means that student learning outcomes increase after using the Instructional Media Design textbooks.

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Credit Financing and its Impact on Entrepreneurship Condition in Cabanatuan City

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Abstract— *This research is entitled Credit Financing and Its Impact on Entrepreneurship Condition in Cabanatuan City. Credit is the granting of a loan and the creation of debt; any form of deferred payment which includes repayment of the original loan amount plus interest (Dave Ramsey 2014). A total of fifty (50) entrepreneurs in Cabanatuan City are chosen as the study's respondents. These people operate small business enterprises in the locality and are regular borrowers from different lending companies in the area. Descriptive normative survey was employed as research method and the questionnaire has been employed as data gathering tool. Snowball sampling was used in locating the respondents. The study first investigated the socio-economic profile of the entrepreneurs based on their: nature of business, average gross sales per month, average net income per month, number of employees, average working capital, total capital investments, and total liabilities. The study also investigated the processes involved in borrowing capital from lending companies, the common problems related in this system, like "payment period is short " and "interest rate is higher" and the benefits of money-lending to the business sector and the impacts of credit financing to the business sector. The respondents' who are all entrepreneurs has an initial capital investment started from 800,000 to one million pesos. Findings showed that most of the respondents have average working capital of 250,000 pesos and below implying they are prone to engagement in money lending activities. On the benefits of shadow banking to the business sector, the first in rank was "It helps enhance additional capital," On the impact of shadow banking in the economic condition of community, highest in rank was "Low earners can avail of loans" and the second in rank was "Encourage small businesses" and the lowest in rank was "People become business oriented".*

Keywords— entrepreneurs; deferred payment; credit financing; shadow banking; capital.

I. INTRODUCTION

Credit financing has always been a very important business activity in many countries. In the third world countries like Philippines, average income earners resorted to credit financing so that they could put up small business. This system freed the people loan sharks who took advantage of their needs for money. In Cabanatuan City alone, a lot of lending companies have been put up to assist on small business people. With reasonable interest rates and less strictness compared with commercial banks, lending companies became popular sources of additional capital for those who are interested to build their own enterprise. The very basic foundation of money-lending companies is the *shadow banking* system. With this universally accepted financing activity, both the lending companies and the business people work hand in hand, and give each one a favor. While the lending companies benefited from the interest rate of their capital, the borrowers are more benefitted as they are able to secure their needed capital. There are concerns that more business may move into the shadow banking system as regulators seek to bolster the financial system by making bank rules stricter. Like regular banks, shadow banks provide credit and generally increase the liquidity of the financial sector. Yet unlike their more regulated competitors, they lack access to central bank funding or safety nets such as deposit insurance and debt guarantees (*Hall 2009*). In contrast to traditional banks, shadow banks do not take deposits. Instead, they rely on short-term funding provided either by asset-backed commercial paper or by the repo market, in which borrowers in substance offer collateral as security against a cash loan, through the mechanism of selling the security to a lender and

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agreeing to repurchase it at an agreed time in the future for an agreed price. Money market funds do not rely on short-term funding; rather, they are investment pools that provide short-term funding by investing in short-term debt instruments issued by banks, corporations, state and local governments, and other borrowers. The shadow banking sector operates across the American, European and Chinese financial sectors and in perceived tax havens worldwide. Shadow banks can be involved in the provision of long-term loans like mortgages, facilitating credit across the financial system by matching investors and borrowers individually or by becoming part of a chain involving numerous entities, some of which may be mainstream banks. Due in part to their specialized structure, shadow banks can sometimes provide credit more cost-efficiently than traditional banks. The International Monetary Fund defines the two key functions of the shadow banking system as securitization-to create safe assets, and collateral intermediation – to help reduce counterparty risks and facilitate secured transactions.

II. STATEMENT OF THE PROBLEM

This study is concerned with the credit financing system which is very common source of funding for small enterprises in Cabanatuan City. Understanding the necessary of financial sources of small business enterprise who cannot meet the requirements from traditional banking system, the researcher would like to provide significant information as to social importance of this system for the entrepreneurial benefits.

III. RESEARCH METHODS

Basically, the study is confined with the investigation on the impact of credit financing toward the entrepreneurship condition in Cabanatuan City. This study use of descriptive method of research which has been defined as a fact finding with adequate interpretation, recording and analysis of the condition that exists. It answers the question "what is' or "what is happening" at present. It attempts to discover relationships between the existing non-manipulated variables. Questionnaire is the primary research instrument used in the study. A questionnaire is a list of planned written questions, related to a particular topic with space provided for indicating the responses to each question and intended for submission to a number of persons for reply. For data analysis, mean degree has been weighted as a form of statistical tool.

IV. CONCEPTUAL FRAMEWORK

This study is conducted to gather opinion of the entrepreneurs/borrowers in Cabanatuan City about money-lending. This study will help to further understand the problems related to borrowing from lending companies, its benefits to the business sector, small entrepreneurs, the business students and faculty and the community. With this aim in view, the researcher believed that in the pursuit for economic progress among small-medium enterprises, more potential entrepreneurs could be knowledgeable as to their partners in putting up businesses.

V. RESULTS AND DISCUSSION

Socio-economic Profile distribution of Small Scale Entrepreneurs in Cabanatuan City

Table 1.1: Distribution of the Respondents as to Nature of business;

Nature of Business	Frequency	Percentage	Ranking
Appliance Centers	14	28	1
Market Stall owners	12	24	2
Dry Goods Store	9	18	3
Restaurant	8	16	4
Others	7	14	5
TOTAL	50	100%	

Table 1.1 Responses showed as per distribution of the nature of business, the appliance centers got the highest rank among the borrowers in shadow financing business. This may be due to their needs to have additional capital to sustain the market demand of their product. Market vendors also ranked significantly. They are more likely to become regular borrowers from lending institutions considering that they are capable to pay in daily basis because everyday they have collections.

Table 1.2: Distribution of the Respondents as to Average gross sales per month;

Sales Distribution	Frequency	Percentage	Ranking
250,000-300,000	16	32	1
300,000-350,000	13	26	2
350,000-400,000	11	22	3
200,000-250,000	7	14	4
Below 200,000	3	6	5
TOTAL	50	100%	

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Table 1.2 shows that most of the respondents have an average daily sales of about P 7,000 to P 10,000 which may show that they are capable to pay the amounts of loans. Since they have satisfactory monthly sales, they can easily obtain the trust of shadow bankers. In most cases, capability to pay is the primary concern in investigating the borrowers.

Table 1.3:Distribution of the Respondents as to Average net income per month;

Location	Frequency	Percentage	Ranking
40,000-50,000	23	46	1
50,000-60,000	17	34	2
30,000-40,000	5	10	3
20,000-30,000	3	6	4
Below 20,000	2	4	5
TOTAL	50	100%	

Table 1.3 Majority of the respondents showed they have average net income of more than P 40,000. Per month. Considering that the same is accounted after the cost of operation, the business status is not bad at all. This further validates their capability to settle financial obligation to lending companies. Though there are entrepreneurs whose net income is lower, they are still able to survive in the competition as they recover the cost of operation from their sales.

Table 1.4: Distribution of Responses as to number of employees;

No. of Employees	Frequency	Percentage	Ranking
4	20	40	1
5	12	24	2
3	9	18	3
2	7	14	4
6 and above	2	4	5
TOTAL	50	100%	

Table 1.4 Responses indicate that most respondents have average size of workers. They have lesser cost for manpower. For some businesses like those in appliance sales, the marketing people are mostly commissioned based.

Table 1.5: Distribution of the Respondents as to Capital Investment

Capital Investment	**Frequency**	**Percentage**	**Ranking**
800,000-1,000,000	13	26	1
Above 1,000,000	11	22	2
600,000-800,000	9	18	3.5
Below 400,000	9	18	3.5
400,000-600,000	8	16	5
TOTAL	**50**	**100%**	

Table 1.5 Respondents entrepreneurs who are involved in appliance and dry goods sales are most likely to invest huge capital for their stocks. Other business people has to invest for the facilities and for the working capital

Table 1.6: Distribution of the Respondents as to total liabilities;

Present Status	**Frequency**	**Percentage**	**Ranking**
Above 500,000	13	26	1
100,000-200,000	12	24	2
200,000-300,000	10	20	3
300,000-400,000	8	16	4
400,000-500,000	7	14	5
TOTAL	**50**	**100%**	

Table 1.6 To analyze the liabilities of the respondents, we can say that liabilities are mostly based on the capital investments and the existing assets. There are business which have lesser liabilities because their working capital requirement is not that big to sustain operation. Generally, shadow banking is favourable to them as their financial demands can be met.

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Table 2: The process involved in borrowing capital from Credit Financing

	SA (5)	f	A (4)	f	MA (3)	f	D (2)	f	SD (1)	f	WM	Interpretation
Completion of loan application	35	175	15	60	0	0	0	0	0	0	4.70	Strongly Agree
Co-maker is necessary	33	165	16	64	1	3	0	0	0	0	4.64	Strongly Agree
Collateral is required for higher amount of loan	30	150	17	68	3	9	0	0	0	0	4.54	Strongly Agree
Determined period of payment	28	140	17	68	5	15	0	0	0	0	4.46	Agree
Character investigation is taken before loan approval	18	90	15	60	17	51	0	0	0	0	4.02	Agree
											4.47	Agree

Table 2 presents the processes involved in borrowing capital from shadow financing. Rank first is "completion of loan application form" Second in rank is "co-maker" and third is "collateral is required for higher amount of loan". Rank fourth is "determine period of payment" and the lowest in rank is 'character investigation is taken prior to loan approval". There were different procedures undertaken before an individual obtain loans from shadow bankers. The borrowers must complete the loan forms required by lending institution. There are policies where the borrowers should pay on daily instalments, while others allow the loan with post-dated checks as the form of payment.

Table 3: Common Problems encountered in dealing with Lending Companies

Variables	SA (5)	f	A (4)	f	MA (3)	f	D (2)	f	SD (1)	f	WM	Interpretation
Payment period is short	33	165	16	64	1	3	0	0	0	0	4.64	Strongly Agree
Interest rate is higher	28	140	17	68	5	15	0	0	0	0	4.46	Agree
Amount of loan is minimal	18	90	15	60	17	51	0	0	0	0	4.02	Agree
Strictness before releasing the loan	17	85	14	56	10	30	9	18	0	0	3.78	Agree
Appraisal of collateral is too low as compared to its assessed value	20	100	10	40	10	30	7	14	3	3	3.74	Agree
Average											4.12	Agree

Table 3 presents the common problems encountered in dealing with lending companies. First in rank is "Payment period is short", second in rank is " Interest rate is higher", third is "amount of loan is minimal" and ranked fourth is "strictness before releasing the loan" and lowest in rank is "appraisal of collateral is too low as compared to its assessed value". The presented data showed that there are certain problems in dealing with shadow banking providers. Policies are quite different from those adopted in commercial banks.

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Table 4: Benefits of Lending Companies to the Business Sector

	SA (5)	f	A (4)	f	MA (3)	f	D (2)	f	SD	f	WM	Interpretation
It help enhance additional capital	18	90	15	60	17	51	0	0	0	0	4.02	Agree
Address financial shortage of the company	17	85	14	56	16	48	3	6	0	0	3.9	Agree
Easier to facilitate loans	18	85	14	56	10	30	9	18	0	0	3.78	Agree
Sometimes do not require collateral for small amount of loan	15	75	15	60		30	10	20	0	0	3.70	Agree
Average											3.85	

Table 4 presents the benefits of shadow banking to the business sector. First in rank was "It helps enhance additional capital", ranked second is "Address financial shortage of the company". Ranked third is "Easier to facilitate loan" and rank lowest is "sometimes do not require collateral for small amount of loans". Shadow financing have significant benefits for the entrepreneurs and the business sector in general. Respondents see the advantages of this system as it may help them avail loans faster and easier.

Table 5: The Impact of Credit Financing in the Economic condition of the community

	SA (5)	f	A (4)	f	MA (3)	f	D (2)	f	SD	f	WM	Interpretation
Low earners can avail of loan	35	175	15	60	0	0	0	0	0	0	4.70	Strongly Agree
Encourage small business	30	150	17	68	6	9	0	0	0	0	4.54	Strongly Agree
Can avail loans without collateral	28	140	17	68	5	15	0	0	0	0	4.46	Agree
People become business oriented	18	90	15	30	17	51	0	0	0	0	4.02	Agree
Average											4.43	

Table 5 presents the impact of shadow banking in the economic condition of the community. Rank highest was "Low earners can avail of loans", ranked second was "encourage small business". Third in rank was "Can make loans without collateral" and lowest in rank was " People become business oriented".

VI. CONCLUSION

In the light of the foregoing, the study concluded that shadow banking in the form of credit financing is a socially desirable financial activity in many localities. While it is true that some people have difficulties to avail of loans, there are advantages they have seen. While it is easier to avail of the loans from lending companies as compared to commercial banks, many respondents said that interest rate is higher and the mode of payment is faster. Aside from that, the appraisal is low when there is collateral as compared to its assessed market value.

VII. RECOMMENDATIONS

As credit financing has great contribution to both the business sector and the community at large, it is highly recommended that efficiency in the implementation of shadow banking principles be adopted in the Philippine setting so as to further benefit small entrepreneurs.

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Disaster preparedness of the selected Barangays in Rizal, Nueva Ecija

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Abstract— *Despite substantial public danger awareness commitment and spending, rates of preparedness for disasters remain low. The study used the descriptive method of research. It was found that the disaster preparedness programs and activities on the selected Barangays in Rizal, Nueva Ecija are effective however, it needs improvement on the implementation of the programs so that it will be more effective. The result on the problems about the implementation of disaster preparedness programs and activities is disgracing because those programs and activities have only one aim: to help the community. Local government may generate everyone awareness on the difficulties of implementing disaster preparedness activities and programs. Also, the barangay may conduct trainings or seminars for the barangay officials about disaster preparedness.*

Keywords— ***Disaster, Preparedness, Disaster Management, Barangay, Disaster Preparedness.***

I. INTRODUCTION

Despite substantial public danger awareness commitment and spending, rates of preparedness for disasters remain low. As viewed by Collin (2000), Disasters take different forms, ranging from natural disasters, such as tornadoes, to man-made disasters, such as incidents of violence in the workplace, and occur far too often. Dekens (2007) stated that it is only recently that real attention has begun to be given to the value of incorporating local knowledge and traditions into construction and environmental programs, but the approach is still far from becoming commonplace.

Kirschenbaum (2002) concluded that management practices aimed at increasing disaster preparedness behaviors must focus on those variables that directly affect each type of preparedness construct separately. Kohn et al. (2012) also concluded that factors affecting preparedness attitudes and behaviors are complex and multifaceted, including demographic characteristics, trust in government efforts, prior catastrophe experience, and the number of household dependents.

Evidenced in the study of Center (2006), concluded that the awareness of the people about the importance of vegetation to protect the environment from landslides is important to indirectly reduce the rate of deforestation and thus enable the population to prevent landslide disasters.

In view of the foregoing insights about disaster preparedness, the researcher had the interest in assessing the disaster preparedness of the selected barangays in Rizal, Nueva Ecija. In this study, the officials of the municipality will be more disaster-prepared that will prevent major damages and casualties to its jurisdiction.

II. CONCEPTUAL FRAMEWORK

Measuring the degree of vulnerability and preparedness of the population as well as realistic awareness and stakeholder understanding of the extent to which preparedness measures should be taken to reduce the risk of disasters in high risk areas is particularly important. (Hidayati, 2012)

This study is mainly anchored on the study of Luna (2000) that stated the nature and extent of government collaboration in disaster preparedness and mitigation issues varies widely depending on their roots, either in past confrontations and political struggles or traditional charitable activities. Supported by Allen (2006), Community-based solutions to disaster preparedness (CBDP) are increasingly important components of policies to mitigate risk and handle disasters.

III. OBJECTIVE OF THE STUDY

The study described the the level of effectiveness of the different programs or activities implemented by the government for disaster preparedness, and problems encountered in the implementation of programs and activities for disaster preparedness in the barangay.

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IV. METHODOLOGY

The study used the descriptive method of research. The Descriptive analysis method is beyond data collection and tabulation. This includes the description elements with the context of what is defined. Thus, description is often combined with the measurement, classification, interpretation, and evaluation of comparison and contrast. (Willis et al., 2016)

V. RESULTS

Table 1 showed that the statement "House to house briefing" obtained the highest weighted mean of (3.22) with a verbal interpretation of "Effective" while statements "Disaster coordination and calamity", "Barangay training and seminars on disaster preparedness", and "Educational Services and Moral Recovery Program" obtained the lowest weighted mean of (2.78) with a verbal interpretation of "Effective".

Table 1. Effectiveness of Disaster Preparedness Programs and Activities

DISASTER PREPAREDNESS PROGRAMS AND ACTIVITIES	Weighted Mean	Verbal Interpretation
1.House to house briefing	3.22	Effective
2. Conducting of Emergency drills	3.20	Effective
3. Rescue Training.	3.10	Effective
4.Training for Senior Citizen and Women in emergency situation	3.10	Effective
5. Basic Life Support Training,.	3.08	Effective
6.Construction of Multi-Purpose Hall for evacuation	3.20	Effective
7.Green Brigade	2.99	Effective
8 Disaster Coordination and Calamity	2.78	Effective
9 Barangay Training and Seminars on Disaster Preparedness	2.78	Effective
10 Educational Services & Moral Recovery Program	2.78	Effective
11. Livelihood Program	2.89	Effective
12.Early preparation of relief goods	2.94	Effective
Total Weighted Mean	3.00	Effective

Table 2 showed that the statement "Lack of interest of the community regarding the preparedness programs initiated" gained the highest weighted mean of (3.22) with a verbal interpretation of "Serious" while statement "Lack of qualified individuals to conduct trainings" gained the lowest weighted mean of (2.69) with a verbal interpretation of "Serious".

Table 2. Problems encountered in the implementation of the programs in the community.

	Weighted Mean	Verbal Interpretation
1. Lack of information dissemination efforts of the barangay officials, about the incoming disaster	3.20	Serious
2. Lack of interest of the community regarding the preparedness programs initiated.	3.22	Serious
3. Lack of communication between community and the official	3.04	Serious
4 Lack of equipment or materials	3.00	Serious
5.Lack of budget of the barangay or LGU's in giving relief goods	3.07	Serious
6.Lack of qualified individuals to conduct trainings	2.69	Serious
7. Absence of the members of the community during information drives	3.16	Serious
8.Lack of Involvement of the barangay official s	2.79	Serious
9.Non-cooperation of the community	3.10	Serious
10 Improper information given by the officials.	2.74	Serious
Total Weighted Mean	3.00	Serious

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VI. CONCLUSION AND DISCUSSION

The disaster preparedness programs and activities on the selected Barangays in Rizal, Nueva Ecija are effective however, it needs improvement on the implementation of the programs so that it will be more effective. The community may support the projects that can be helpful for the community by participating in every activity provided by the barangay.

The result on the problems about the implementation of disaster preparedness programs and activities is disgracing because those programs and activities have only one aim: to help the community. Local government may generate everyone awareness on the difficulties of implementing disaster preparedness activities and programs. Also, the barangay may conduct trainings or seminars for the barangay officials about disaster preparedness.

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Experimental and Analytical Investigation of Reinforced Concrete Beams with Large Web Opening under Pure Torsion

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Abstract**—** *This research presents the experimental and analytical results for reinforced concrete (RC) beams with rectangular large web openings under pure torsion. Fifteen specimens were tested; one solid specimen without opening, six specimens without reinforcement around opening as if an opening is created in an existing beam; where the investigated parameters were opening width, opening height and opening eccentricity from the longitudinal beam axis, and eight specimens with reinforcement installed around the opening to reduce the effect of the opening on the torsional behavior; where the investigated parameters were the shapes and amounts of the reinforcement around the opening. The test results showed that installing stirrups and horizontal reinforcement bars in the chords above and below the openings efficiently increased the cracking and ultimate torque of the tested specimens; where using inclined stirrups by 45° to the longitudinal axis of the specimens increased the ultimate torque to be about 90% of that of the solid specimen. Installing closed stirrups around the opening had small effect on enhancing the torsional behavior of the tested specimen compared with using horizontal and vertical reinforcement bars. The analytical model based on Modified Variable Angle Truss Model (MVATM) used to obtain the torque-rotation curves for beams under pure torsion was modified to incorporate the beams with large web opening which have different arrangements of reinforcement around the opening. MATLAB program language was used to obtain the analytical torque-rotation curves for the specimens that have reinforcement around the opening which were in good agreement with the experimental results.*

Keywords**— pure torsion, web opening, reinforced concrete beams, Modified Variable Angle Truss Model.**

I. INTRODUCTION

In most buildings, the need for openings in the structural elements became very necessary to pass pipes, air conditioning, and service ducts. The openings in the beams may take different shapes with different dimensions depending on the service conditions. Creating a web opening will modify the behavior of the beam to be more complex. The design of RC beams under torsional moment in the present different building codes [1-3] are based on the investigations carried out on solid concrete beams. In addition, the codes do not give any recommendations for the design of concrete beams with opening subjected to torsional moment. The openings are classified according to their dimensions into two categories, large openings and small openings. Mansur et al. [4] and Abul Hasnatet al. [5] defined the large openings to have a length greater than the height of the chord above or below the opening, and the small openings otherwise.

There are many previous researches conducted on the effect of the presence of openings on the torsional behavior of RC beams. Mansur et al. [4] studied the effect of the opening dimensions and their locations on the behavior of RC beams under pure torsion. El Badry [6] investigated the behavior of high strength RC beams with web opening under pure torsion theoretically and experimentally, the variables were the concrete strength, the opening sizes and their locations. El badawy [7] studied the effect of the beam width, the opening dimensions and the existence of vertical stirrups on the behavior of RC beams with opening under pure torsion. Abdo et al. [8] investigated the behavior of beams tested under pure torsion with the variables being, the beam depth, the number of the openings, and the spacing between stirrups. Salama et al. [9] carried out an experimental and theoretical investigation on torsional behavior of T-shaped RC beams with large web openings, the study's parameters were flange width, flange thickness, and opening height. Other researches [10-15] studied the strengthening of concrete beams with opening subjected to pure torsion using Fiber Reinforced Polymers. However, most of these researches focused on the geometric dimensions of the openings and did not focus on the effect

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of installing reinforcement around the opening to reduce its effect on the torsional behavior of the beams.

In the last century, a huge number of researchers agreed that the truss model is the most powerful method for reinforced concrete sections subjected to torsion. Raush [16] extended the 45° truss model for shear design to torsion design. Hsu and Mo [17] have found that, the Rausch's equations overestimated the actual torsional strength of the beams, and as a result, they developed Variable Angle Truss Model (VATM) equations to correct the difference between the experimental and theoretical results. In VATM at the stages before reaching the ultimate torque, there was a difference between theoretical and analytical torque-rotation curves because of the assumption that the beam is cracked from zero load. Bernardo et al. [18-21] had modified the VATM (MVATM) to be capable of predicting the behavior of the beams under torsion for all loading stages, but this model is not capable of predicting the torsional behavior for beams with web opening under pure torsion.

The main objectives of this study are to evaluate the effect of installing reinforcement around large web opening in beams under pure torsion and modifying the MVATM developed by Bernardo et al. to predict the whole torsional behavior of the beams with web openings. The calculation algorithm that integrates the opening with different reinforcement arrangements around it in the MVATM is computationally performed by means of MATLAB program language. The predicted torque-rotation curves for the tested specimens showed good agreement with the experimental ones.

II. EXPERIMENTAL PROGRAM

2.1 Specimens and test matrix

Fifteen specimens were casted and tested to investigate torsion behavior of RC beams with large web opening. All tested specimens had rectangular cross-sections with an overall depth of 300 mm and width of 200 mm, and a total length of 1700 mm. The middle part of the specimens with 1300 mm length was the test zone, which was subjected to pure torsional moment during testing. Each of the specimens had cantilever end parts, which were loaded with two concentrated loads at their ends to produce the torsional moment in the specimens. These cantilevers were heavily reinforced in order to prevent any type of failure during the test. For all the tested specimens, the longitudinal reinforcement consisted of four deformed bars with 12 mm diameter at each corner of the cross-section extending over the full length of the specimen. The transverse reinforcement of the specimens was 10 mm diameter at 200 mm distance. Fig. 1 shows the dimensions and reinforcement details for tested specimens.

Tested specimens had one without opening to be a reference specimen and the reminder tested specimens were sorted in two groups. The first group (group I) included six specimens without reinforcement around opening as if an opening is created in an existing beam. The test parameters were the ratio of the opening width (b_o) to the height of the specimen (T), the ratio of the opening height (h_o) to (T) and finally the ratio of the opening eccentricity from the longitudinal beam axis (e) to (T), as shown if Fig. 2.The second group (group II), included eight specimens that had the same opening dimensions (60 mm height and 600 mm width) with different shapes and amount of reinforcement around the opening, in order to reduce the effect of the opening on the torsional behavior. The details of the installed reinforcement around the openings are shown in Fig. 3.Table 1 summarizes the details for all tested specimens.

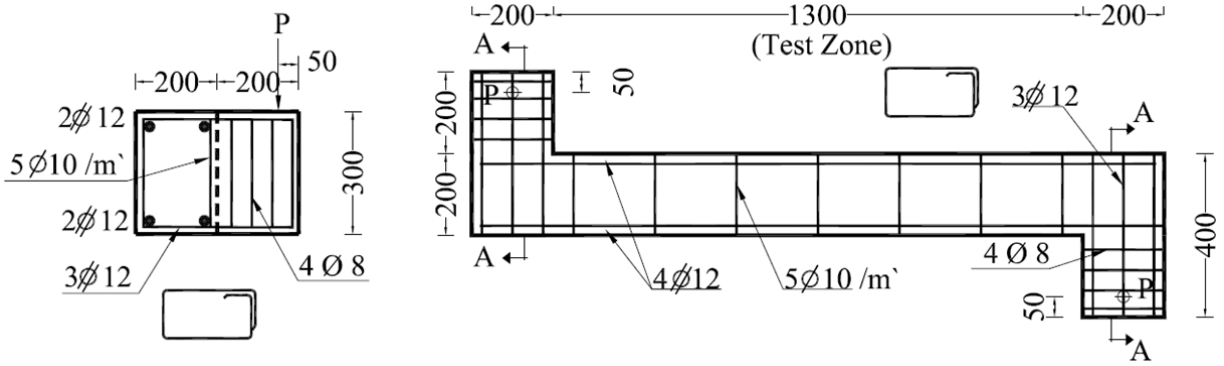

Fig. 1.The dimensions and reinforcement details for tested specimens

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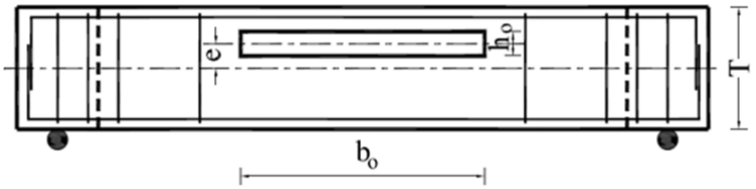
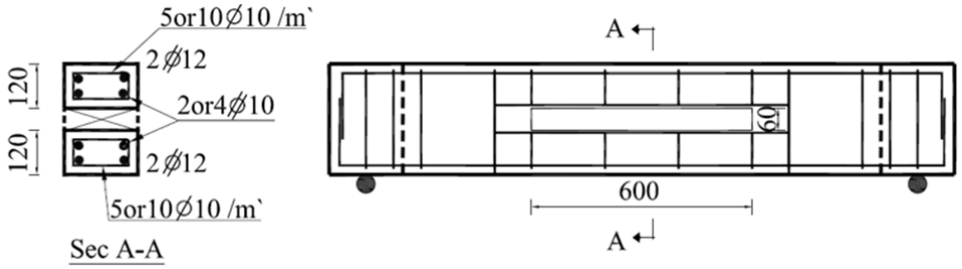
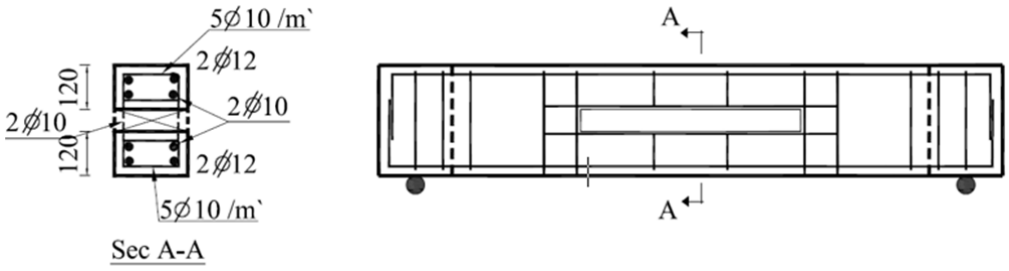


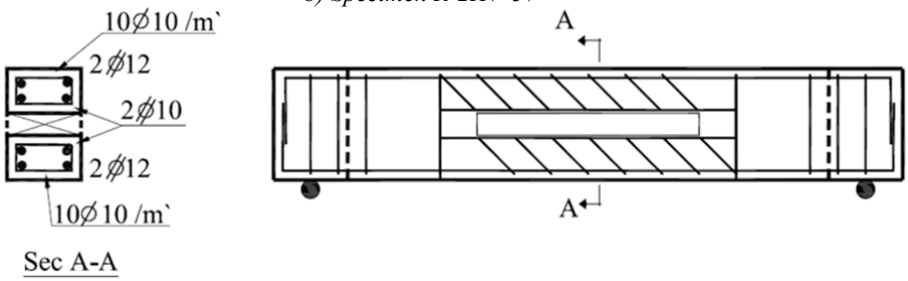
Fig. 2. Notation of the opening for group I



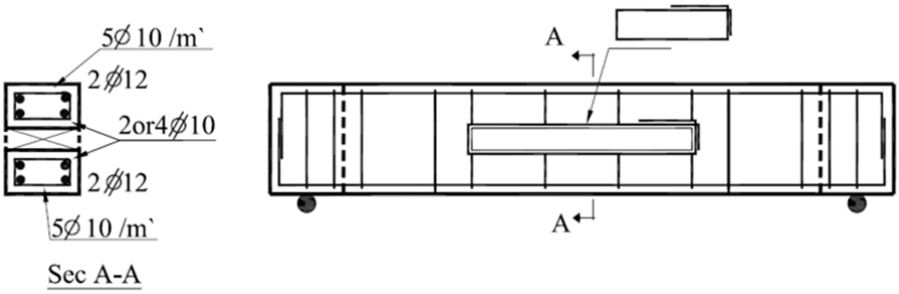
a) Specimens R-2H-5V, R-2H-10V, R-4H-5V and R-4H-10V



b) Specimen R-2HV-5V



c) Specimen R-2H-10I



d) Specimens R-2S-5V and R-4S-5V

Fig. 3.Reinforcement details around the opening for group II

The nomenclatures for the two tested groups are shown in Fig. 4.Forgroup (I), the first letter (O) indicates that the specimen without reinforcement around the opening, the second number indicates the ratio (b_o/T),the number after the hyphen points the ratio (h_o/T) and the number after the second hyphen refers to the ratio (e/T).For group II, the

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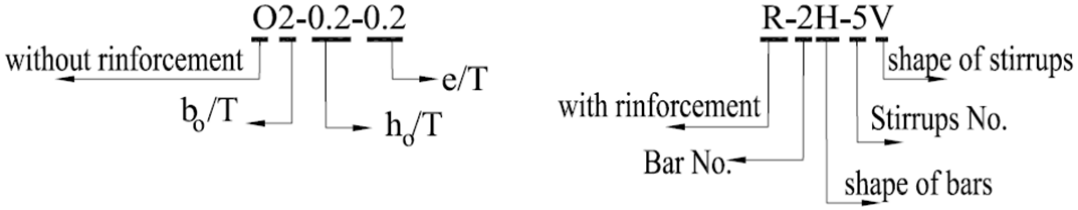
first letter (R) indicates that the specimen with reinforcement around the opening, the number and the letter after the first hyphen indicate the amount of reinforcement bars around the opening and its locations (H: Horizontal, HV: Horizontal and vertical, and S: Stirrups),the number and the letter after the second hyphen refer to the number of stirrups and their inclination states respect to the longitudinal axis of the specimen in the chords above and below the opening (V: Vertical, and I: Inclined).



a) Without reinforcement around the opening *b) With reinforcement around the opening*

Fig. 4. Nomenclatures for the tested specimens

Table 1: Outline of experimental program

Test group	Specimen code	Opening size		Opening* location	Reinforcement bars around the opening		Stirrups in the chords above and below the opening	
		Width (b_o) mm	Depth (h_o) mm		Top and bottom	Left and right	No. /m`	Inclination angle**
Solid	S	–	–	–	–	–	–	–
Group (I)	O1-0.2	300	60	at center	–	–	–	–
	O2-0.2	600			–	–	–	–
	O1-0.4	300	120		–	–	–	–
	O2-0.4	600			–	–	–	–
	O2-0.2-0.1		60	30 mm	–	–	–	–
	O2-0.2-0.2			60 mm	–	–	–	–
Group (II)	R-2H-5V	600	60	at center	2	–	5	90
	R-2H-10V					–	10	
	R-4H-5V				4	–	5	
	R-4H-10V					–	10	
	R-2HV-5V				2	2	5	
	R-2H-10I					–	10	45
	R-2S-5V				2 as closed stirrups		5	90
	R-4S-5V				4 as closed stirrups		5	

*Vertical distance between centerline of the opening and the longitudinal axis of the specimen.
**Respect to the longitudinal axis of the specimen.

2.2 Material properties

The specimens that were tested in this investigation were made from local materials. The aggregate was composed from natural sand with 2.7 fineness moduli and 16 mm maximum aggregate size crushed dolomite. Cement used was Ordinary Portland Cement (OPC-42.5 grade). The target concrete compressive strength (f_{cu}) was 30MPa. The actual f_{cu} was determined from cubes casted and cured simultaneously with the tested specimens. The steel bars of 8 mm diameter were mild steel, and steel bars of 10 mm and 12 mm diameter were high grade steel. The measured yield strength of 10 mm and 12 mm diameter were 435 and 525MPa, respectively.

2.3 Test setup

The test set-up is executed to apply pure torsion on the test zone of the specimens which were simply supported on two movable supports, capable of rotation and inclination in the vertical direction. The torsion was applied to the specimens by applying two downwards concentrated loads at the ends of the cantilevers parts by using hydraulic jack

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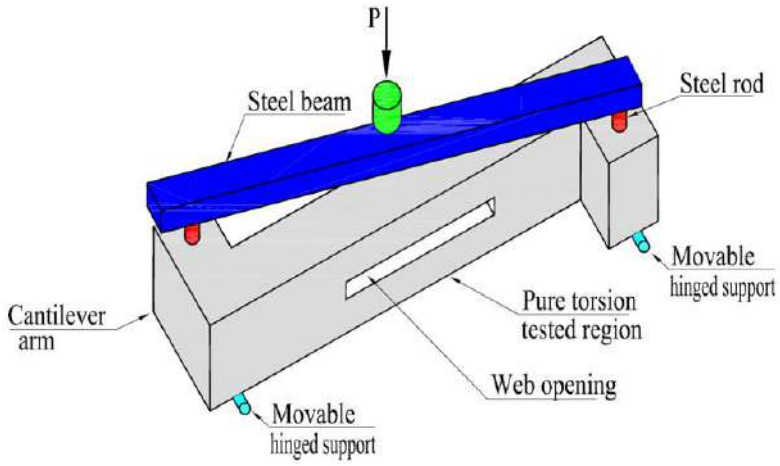
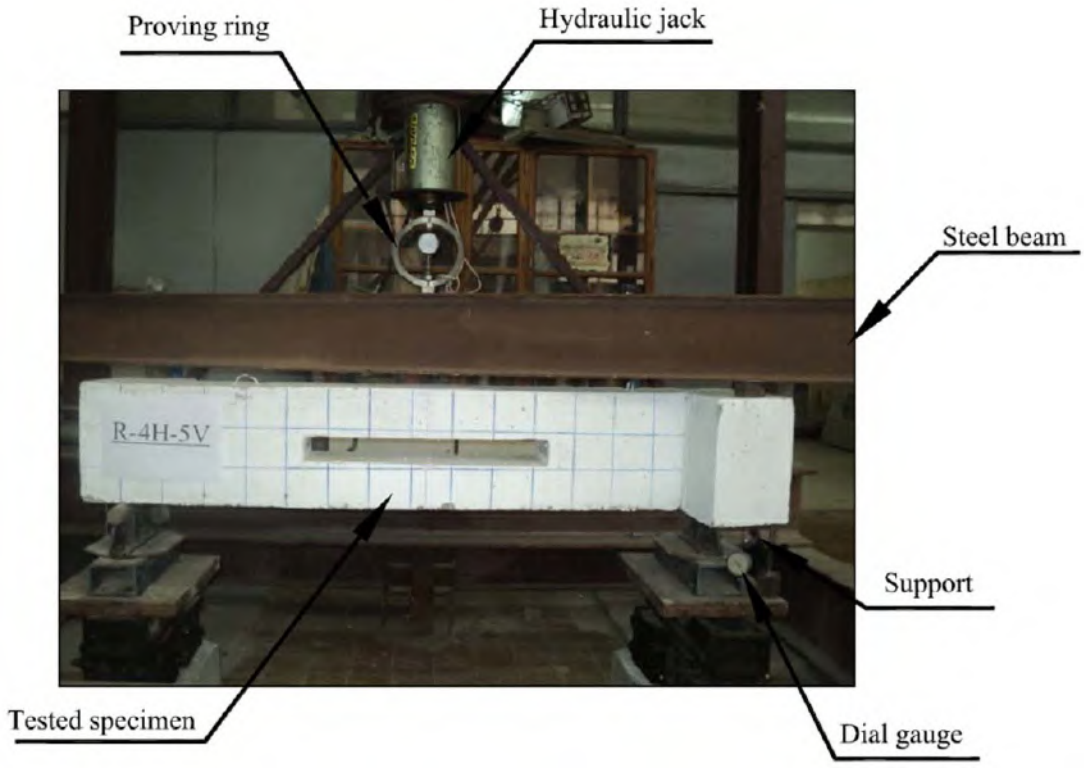
of 100 kN capacity connected to a proving ring to measure the vertical load. The applied load was distributed equally to the two cantilever parts by rigid spreader steel beam, and transferred to the point load on the cantilevers by a steel rod. Two dial gauges mounted under both loaded points to measure the deflections during the experimental test in order to determine the rotation angle. All specimens were loaded incrementally until failure. The side surfaces of the specimens were painted in a white color to aid the observation of the cracks development during testing. All cracks propagation were monitored. The test setup is shown in Fig. 4.



a) Schematic test setup.



b) Test setup and support details.

Fig. 4. General view of experimental setup.

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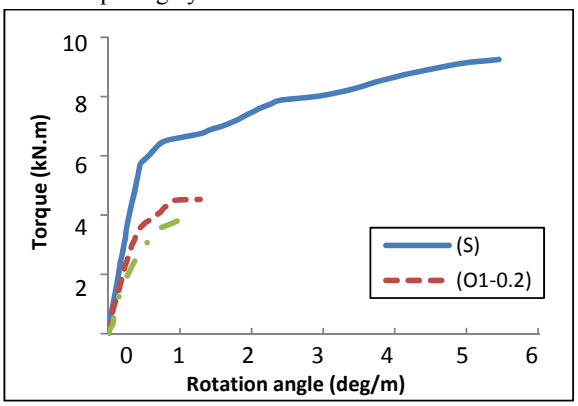
III. TEST RESULTS AND DISCUSSIONS

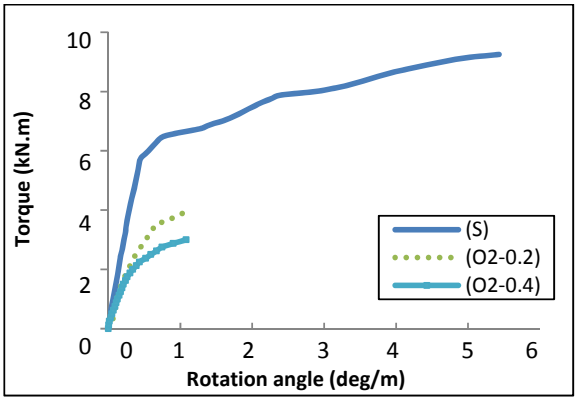
3.1 Torque–Rotation curves

3.1.1 Specimens without reinforcement around opening

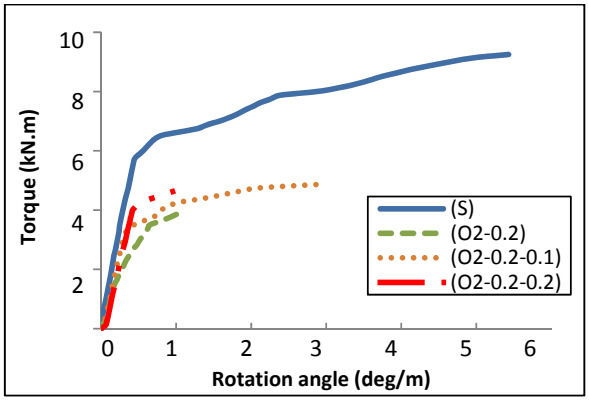
The torque-rotation relationship for the specimens of group I were compared with that of the solid specimen, as shown in Fig. 5. It is noted that the torsional curves were divided into two sections. The first section of the curves was linear up to the cracking torsion, and the solid specimen behaved as plain concrete and similar to the specimens without reinforcement around opening. The second section of the curves was nonlinear and the rotation angle increased rapidly with increasing the torsional moment indicating the post-cracking behavior, and was very short for the specimens of the group I which rapidly failed after cracking. In comparing with the solid specimen, the rotation angles decreased from 11-15% when the opening length increased from 300 mm to 600 mm, while the rotation angle decreased from 2-5% when the opening depth increased from 60 mm to 120 mm. The torsional behavior of the specimen with eccentric opening by 0.1 the beam height, *T*, was the best compared to the specimen with concentric opening and the specimen with eccentric opening by 0.2 *T*.



a) Specimens with variable opening length



b) Specimens with variable opening depth

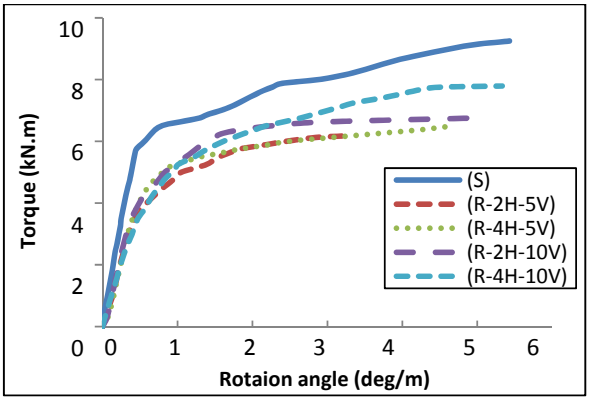


c) Specimen with variable opening location

Fig. 5. Torque-Rotation curves for the specimens without reinforcement around opening

3.1.2 Specimens with reinforcement around opening

The first and the second sections of the torque-rotation curves for the specimens of group II behaved similar to that of group I, except that the rotation angles and the torsional moments increased due to the effect of installing reinforcement around the openings, as shown in Fig. 6. The rotation angles increased 12-52% when the vertical stirrups in the chords above and below the opening increased from 5Ø10/m to 10Ø10/m. While, the rotation angles increased 10-44% when the longitudinal reinforcement bars above and below the opening increased from 2Ø10 to 4Ø10. The rotation angles are almost equal for the different shapes of reinforcement around the opening, which were either stirrups or horizontal and vertical reinforcement bars. The rotation angle increased about 10% when the stirrups inclined by 45º to the longitudinal axis of the specimen comparing with that with vertical stirrups. From Fig. 6, specimen R–2H–10I is the nearest one to the solid specimen, because using inclined stirrups in the perpendicular direction to the fracture lines that were inclined by 45°.



a) Variable longitudinal reinforcement bars and stirrups in the chords above and below opening

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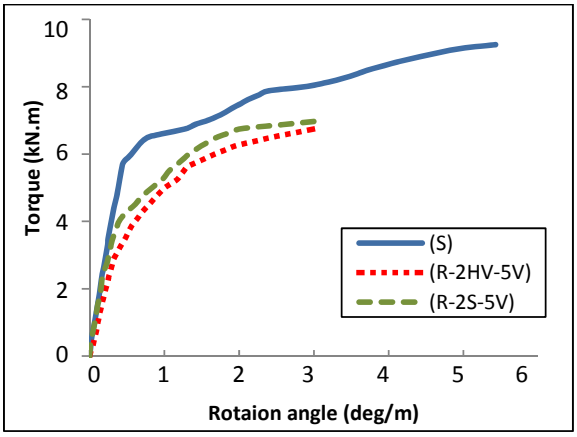
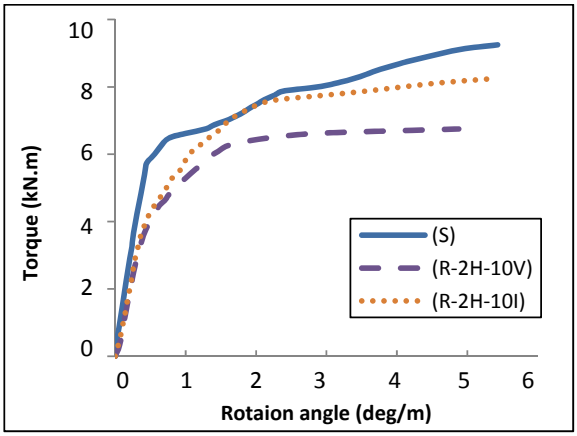


b) Variable shape of reinforcement around the opening



c) Variable stirrups inclination in the chords above and below the opening

Fig. 6 Torque-Rotation curves for the specimens with reinforcement around opening

3.2 Cracking and ultimate torsional moment

For all tested specimens, table 1 summarizes the torque and rotation angles at cracking and ultimate stage.

3.2.1 Specimens without reinforcement around opening

The cracking load, $T_{cr,}$ and the ultimate load, T_u, decreased with increasing the opening length or depth. As the opening length increased from 300 mm to 600 mm, T_{cr} and T_u decreased by 16-30% and 11-22%, respectively, while for specimens with opening height that increased from 60 mm to 120 mm, T_{cr} and T_u decreased by 20-40% and 14-25%, respectively. Increasing the opening eccentricity to be 0.1 T, increased T_{cr} and T_u more than increasing the opening eccentricity to be 0.2 T. Whilst, comparing to the specimen with concentric opening, T_{cr} and T_u increased by 30% and 27%, respectively, for specimen O2-0.2-0.1 with opening eccentricity 0.1 T, while T_{cr} and T_u increased by 25% and 16%, respectively, for specimen O2-0.2-0.2 with opening eccentricity 0.2 T.

3.2.2 Specimens with reinforcement around opening

The reinforcement around the opening had a great improvement on the cracking and ultimate torque for tested specimens. Increasing the horizontal reinforcement above and below the opening from 2Ø10 to 4Ø10 increased T_{cr} and T_u by 4-10% and 5-15% respectively. The increase of the numbers of stirrups and inclining them to the longitudinal axis of the specimen by 45º in the chords above and below the opening had a great effect on T_{cr} and T_u. Where increasing the vertical stirrups from 5Ø10/m to 10Ø10/m increased T_{cr} and T_u by 11-18% and 9-20% respectively, while for the specimen with inclined stirrups T_{cr} and T_u increased by 13% and 22% compared with the specimen with vertical stirrups. T_{cr} and T_u for the specimens R-2S-5V and R-4S-5V that having closed stirrups around the opening slightly increased more than that for the specimen R-2HV-5V having vertical and horizontal reinforcement bars around the opening. Comparing the previous specimens, which having different arrangements of reinforcement around the opening, with the specimen R-2H-5V that having only horizontal reinforcement bars above and below the opening T_{cr} and T_u increased by 9-13% and 14-18%, respectively.

3.3 Cracking behavior and failure modes

From the observation during the experimental work and from the cracks configuration, all the tested specimens had failed in torsion. For the solid specimen, the cracks were diagonal by inclined angle 45º with the longitudinal axis of the specimen. With increasing the load, diagonal cracks were spread out to perform spiral trajectories on the four sides of the specimens as shown in Fig. 7.a.

For the specimens without reinforcement around opening, the first crack appeared at a corner of the opening and the cracks were concentrated at the chords above and below the opening and no cracks propagated in the solid parts of the beam. The numbers of cracks formed in the two chords were small. The failure occurred either at the top chord above the opening or the bottom chord below the opening. Also cracks performed spiral trajectories on the four sides of the chords, as shown in Fig. 7.b.

For the specimens with reinforcement around opening, the number of cracks in the chords above and below the opening was greater than that in the specimens without reinforcement, and the cracks appeared in the solid parts of the specimens. The number of cracks increased with increasing the amount of reinforcement around the opening, especially increasing the stirrups in the chords above and below the opening. The failure occurred in one of the chords above or below the opening, as shown in Fig. 7.c.

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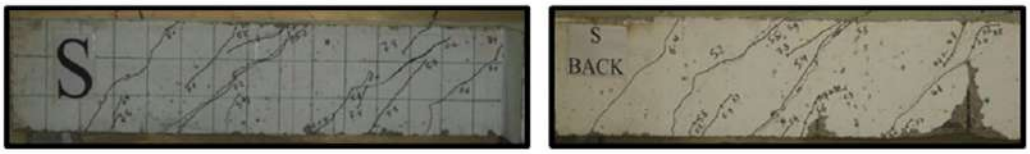
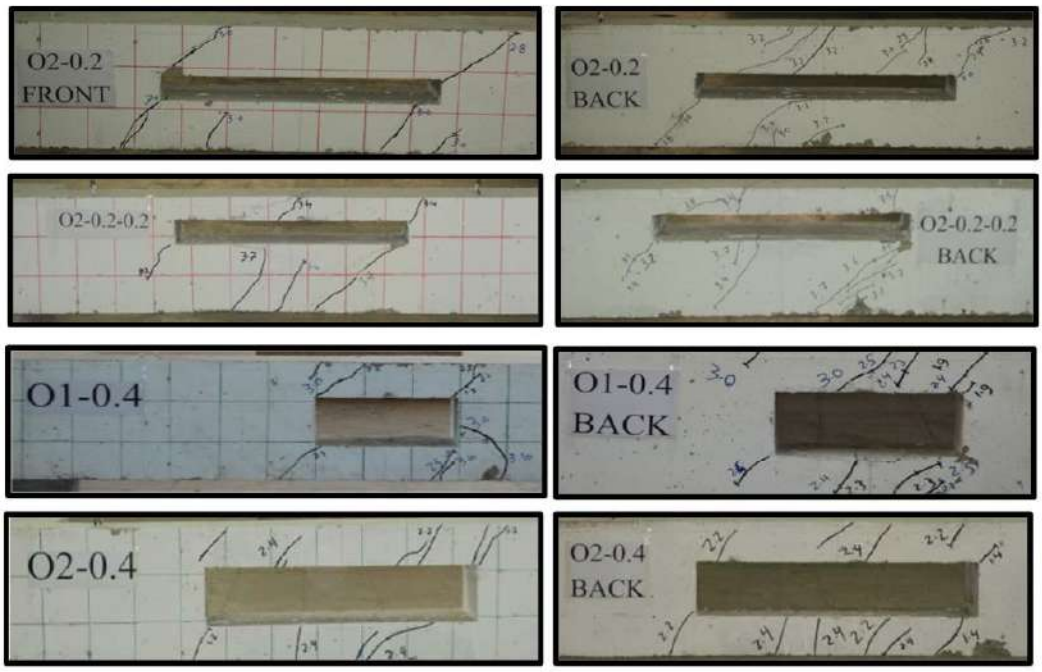
Table 2: Experimental results

Specimen code	f_{cu}	1st Cracking		Ultimate	
	MPa	T_{cr}(kN.m)	θ_{cr}(deg/m)	T_u(kN.m)	θ_u(deg/m)
S	32.2	6.00	0.50	9.25	5.14
O1–0.2	31.8	3.00	0.29	4.53	1.20
O2–0.2	31.5	2.50	0.34	4.00	1.09
O1–0.4	31.2	2.38	0.23	3.87	1.14
O2–0.4	32.2	1.50	0.17	3.00	1.06
O2–0.2–0.1	30.5	3.25	0.29	4.88	2.80
O2–0.2–0.2	30.4	3.12	0.34	4.63	0.92
R–2H–5V	30.3	3.38	0.40	6.18	3.09
R–2H–10V	30.0	3.75	0.40	6.75	4.63
R–4H–5V	30.0	3.5	0.40	6.50	4.46
R–4H–10V	31.5	4.13	0.63	7.79	5.08
R–2HV–5V	31.8	3.88	0.57	6.75	2.86
R–2H–10I	33.3	4.25	0.46	8.25	5.13
R–2S–5V	31.8	4.00	0.34	7.00	2.97
R–4S–5V	31.7	4.00	0.40	7.05	3.55



a) Crack pattern for the solid specimen



b) Crack pattern for the specimens without reinforcement around the opening

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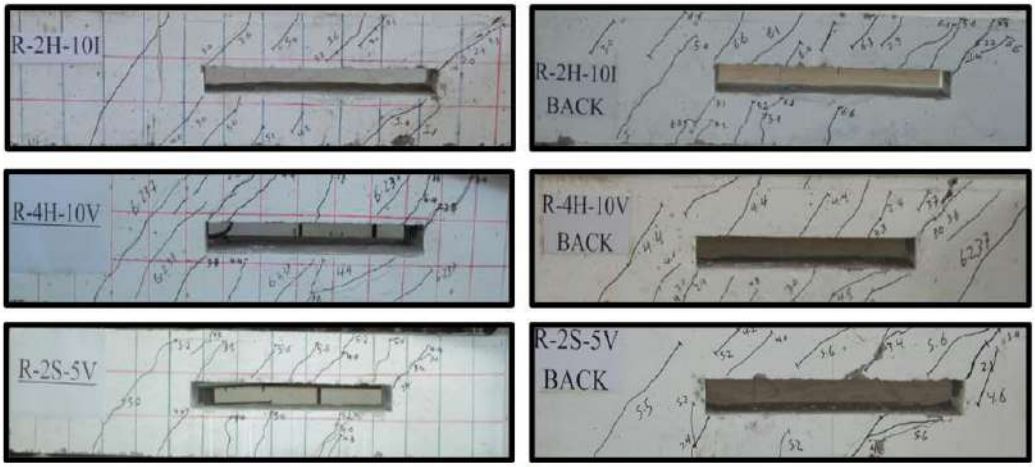


c) Crack pattern for the specimens with reinforcement around the opening

Fig. 7. Cracking patterns for some of tested specimens

IV. ANALYTICAL MODEL

There were two main different theories to predict the ultimate strength of reinforced concrete members subjected to torsion, Skew Bending theory and Space Truss Model theory, the first theory is the basis of the old building codes, and the second theory was the basis of the new building codes.

Rausch has divided the Space Truss Model theory into Truss Analogy and Variable Angle Truss Model (VATM). In VATM when the beam is subjected to torsional moment, it is assumed that the cross section is quintessential to a thin walled tube, the longitudinal bars will become the top and bottom chords of the truss, the stirrups will act as vertical members of the truss, and the perimeter of the outer sides of the concrete beam will act as a series of diagonal strut members, while the concrete core will be neglected as shown in Fig. 8.

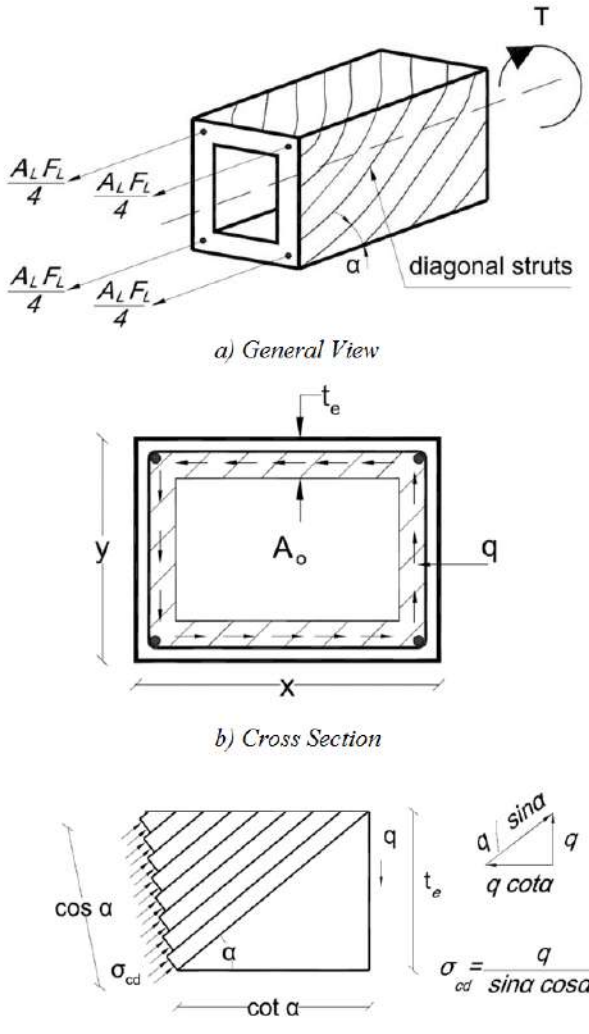
Hsu and Mo have found that the Rausch's equation overestimated the actual torsional strength of member; thus, they developed VATM equations according to stress equilibrium, strain compatibility and constitutive laws of materials to correct the difference between the experimental and theoretical results. Hsu and Mo had derived three equilibrium equations to calculate the torque, T, the inclined concrete strut angle, α, and effective wall thickness, t_e, as follows:

$$T = 2\,A_o t_e \sigma_{cd} \sin\alpha \cos\alpha \quad (1)$$

$$\cos^2\alpha = \frac{A_L f_l}{P_o \sigma_{cd} t_e} \quad (2)$$

$$t_e = \frac{A_L f_l}{P_o \sigma_{cd}} + \frac{A_t f_t}{S \sigma_{cd}} \quad (3)$$

Where A_L is the total area of the longitudinal reinforcement, f_l is the steel stress in the longitudinal reinforcement, A_t is the area of one leg of the closed stirrups, f_t is the stress in the closed stirrups, S is the



a) General View

b) Cross Section

c) Wall Element

Fig. 8. Equilibrium of box section subjected to torsion

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spacing between the closed stirrups, A_o is the area limited by center of the flow of the shear stresses as shown in Fig. 8-a, $A_o=(x-t_e)(y-t_e)$, P_o is the perimeter of area A_o, where $P_o=2((x-t_e)+(y-t_e))$,and σ_{cd} is the stress in the diagonal concrete strut.

To solve a concrete member subjected to torsion by VATM it needs another three compatibility equations to compute the strain of stirrups, ε_t, the strain in the longitudinal reinforcement, ε_l, and the angle of twist, θ, which is estimated as follows:

$$\boldsymbol{\varepsilon_t = \left(\frac{A_o^2\sigma_{cd}}{p_o T\tan\alpha} - \frac{1}{2}\right)\varepsilon_{ds}} \quad \textbf{(4)}$$

$$\boldsymbol{\varepsilon_l = \left(\frac{A_o^2\sigma_{cd}}{p_o T\cot\alpha} - \frac{1}{2}\right)\varepsilon_{ds}} \quad \textbf{(5)}$$

$$\boldsymbol{\theta = \frac{\varepsilon_{ds}}{2t_e \sin\alpha\cos\alpha}} \quad \textbf{(6)}$$

Where ε_{ds} is the maximum compressive strain in the external surface of the concrete strut and taken as 0.0035.

The stress-strain (σ–ε) relationship for compression concrete diagonal struts must be adopted taking into consideration the softening effect for concrete, as shown in Fig. (9). Belarbi and Hsu [22] proposed (σ–ε) relationship with softening factor for maximum stress in concrete, β_σ, and Zhang and Hsu [23] proposed the softening strain corresponding to maximum stress, β_ε. The stress-strain (σ–ε) relationship with the softening factors is as follows:

$$\boldsymbol{\sigma_{cd} = \beta_\sigma f_c^{`}\left[2\left(\frac{\varepsilon_{ds}}{\beta_\varepsilon\varepsilon_o}\right) - \left(\frac{\varepsilon_{ds}}{\beta_\varepsilon\varepsilon_o}\right)^2\right] \quad if\ \varepsilon_{ds} \le \beta_\varepsilon\varepsilon_o} \quad \textbf{(7)}$$

$$\boldsymbol{\sigma_{cd} = \beta_\sigma f_c^{`}\left[1 - \left(\frac{\varepsilon_d - \beta_\varepsilon\varepsilon_o}{2\varepsilon_o - \beta_\varepsilon\varepsilon_o}\right)^2\right] \quad if\ \varepsilon_{ds} > \beta_\varepsilon\varepsilon_o} \quad \textbf{(8)}$$

Where:

$$\boldsymbol{\beta = \beta_\varepsilon = \beta_\sigma = \frac{R(f_c^{`})}{\sqrt{1+\frac{400\,\varepsilon_{el}}{\eta}}}} \quad \textbf{(9)}$$

$$\boldsymbol{\eta = \frac{\rho_l f_{syl}}{\rho_t f_{syt}}} \quad \text{Where} \begin{cases} \eta \le 1 \Rightarrow & \eta^{`} = \eta \\ \eta > 1 \Rightarrow & \eta^{`} = \frac{1}{\eta} \end{cases} \quad \textbf{(10)}$$

$$\boldsymbol{R(f_c^{`}) = \frac{5.8}{\sqrt{(f_c^{`})(MPa)}} \le 0.9} \quad \textbf{(11)}$$

$$\boldsymbol{\varepsilon_{el} = 0.7(f_c^{`})^{0.31}(MPa)} < 2.8 \quad \textbf{(12)}$$

Where $f_c^{`}$ is the cylindrical concrete compressive strength = 0.80 f_{cu} , ε_{el} is the tensile strain in the perpendicular direction of the strut, ρ_l and ρ_t are the longitudinal and transversal reinforcement ratio, respectively, f_{syl}, and f_{syt} are yielding stress for longitudinal and transversal respectively, reinforcement.

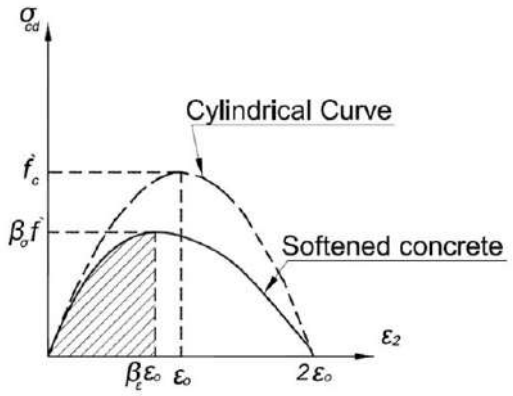

Fig. 9. Stress-strain relationship for the compressed concrete strut

The stress of concrete diagonal struts, σ_{cd}, is obtained as follows:

$$\boldsymbol{\sigma_{cd} = k_1\beta f_c^{`}} \quad \textbf{(13)}$$

Where K_1 is the ratio of the average stress to the maximum stress for the stress diagram of the concrete struts and obtained by integration of Eqs. (7) and (8).

The VATM is very successful in predicting the ultimate torsional moment for a concrete beam, but cannot predict the whole torsional behavior of the beam. However in VATM the concrete core is neglected, but in the stages before the ultimate load the concrete beams is not fully cracked, that leads to a difference between theoretical and experimental *T-θ* curves. Bernardo et al. had adjusted VATM which became Modified Variable Angle Truss Model (MVATM) to be able to predict the behavior of reinforced concrete beam under torsion in all loading stages. Bernardo et al. divided the *T-θ* curves into three zones according to the experimental results as shown in Fig. 10. Where zone 1 is non-cracking state, zone 2.a is cracked state, and finally zones 2.b and 3 are cracked state and ultimate state.

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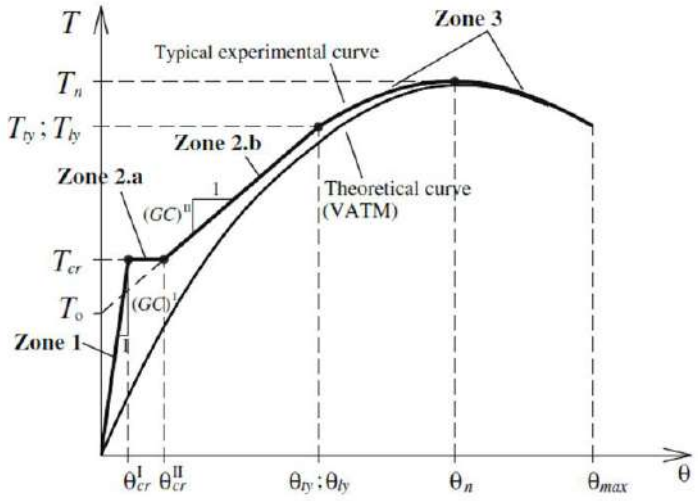

Fig. 10 Theoretical T-θ curves for a RC beam under pure torsion, Bernardo et al. [18]

In zone 1, the cracking torsional moment, T_{cr}, is set to be the limit for this zone. To correct the VATM results, the contribution of the concrete core in resisting torsion must be involved by adding the torsional stiffness of the concrete core, K_c, to the each calculated points of *T-θ* curve as follows:

- Calculate the equivalent torsional stiffness

$$\boldsymbol{K_{eq} = \frac{T}{\theta}} \quad \textbf{(14)}$$

- Calculate the torsional stiffness of the concrete core

$$\boldsymbol{K_c = 0.292\, E_c\, C} \quad \textbf{(15)}$$

- Calculate the total torsional stiffness

$$\boldsymbol{K_t = K_{eq} + K_c} \quad \textbf{(16)}$$

- Calculate the corrected twisting angle

$$\boldsymbol{\theta_{cor} = \frac{T}{K_t}} \quad \textbf{(17)}$$

Where C is torsional factor $=\boldsymbol{\Omega x^3 y}$, x and y are the smallest and largest dimensions of the section, Ω is St. Venant's coefficient [24], E_c Young's modulus of the concrete calculated according to ECP-203 [3].

Hsu and Mo proposed the following equation to compute T_{cr}.

$$\boldsymbol{T_{cr} = 2A_c t(0.2076\sqrt{f_c(MPa)})} \quad \textbf{(18)}$$

Hsu [25] proposed an empirical equation to estimate the effective cracking torque, T_{cref}, which considering the effect of both longitudinal and transversal reinforcement in the cracking torque as follows:

$$\boldsymbol{T_{cref} = [1+4(\rho_l+\rho_t)]\, T_{cr}} \quad \textbf{(19)}$$

Where t is the wall thickness $= \frac{\boldsymbol{1.2A_c}}{\boldsymbol{p_c}}$, A_c and P_c are the area and the perimeter limited by the outer perimeter of the section.

In zone 2.a, the torque is constant while the rotation angle increases with relatively small value. This stage is neglected in this research.

In zone 2.b and 3, the calculated torsional moments from *T-θ* curve are in good agreement with the experimental results, but the twisting angles must be corrected to take into account that the concrete core is not fully effective in the model as before. Where the torsional stiffness of the concrete core decrease from T_{cref} to the ultimate torsional moment, T_n. As a result, the rotation angles in this stage increase linearly from T_{cref} to T_n by $\Delta\theta$ which is equal to zero at T_n and with full value at T_{cref}, as shown in Fig. 11, and $\Delta\theta$ is calculated as follows:

$$\boldsymbol{\Delta\theta_{cor} = \theta_n - \theta_{n,cor}} \quad \textbf{(20)}$$

Where θ_n is the rotation angle corresponding to T_n calculated from VATM and $\theta_{n,cor}$ is the rotation angle corresponding to T_n calculated from MVATM.

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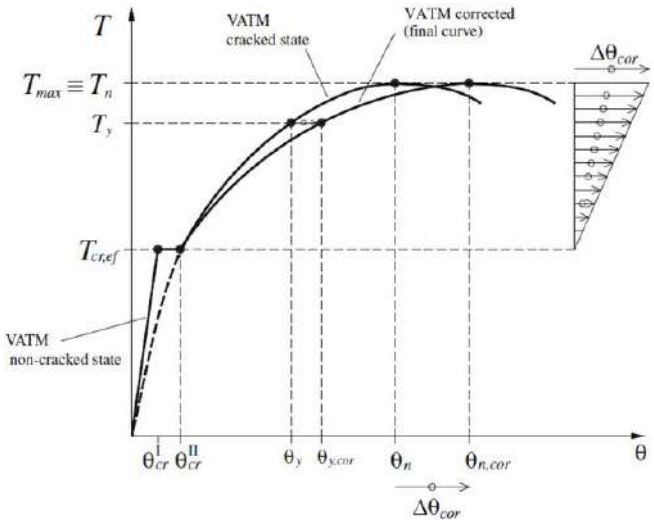
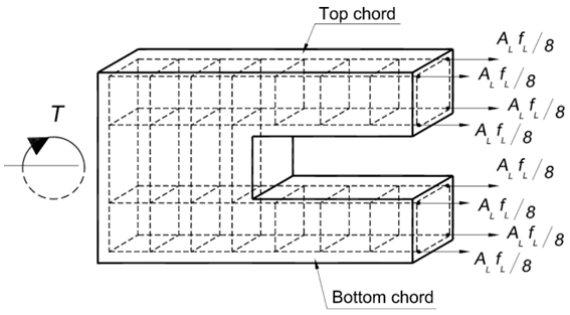


Fig. 11. Correction of T-θ curve for zone 2-b and 3, Bernardo et al. [18].

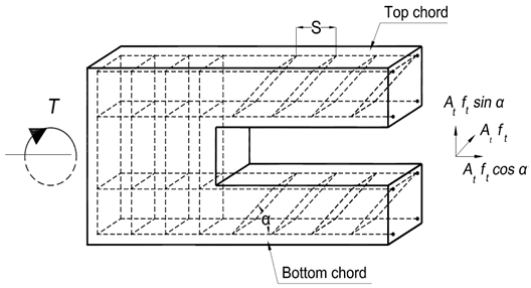
To apply MVTAM on the RC beams with web opening, the chords above and below the opening simulated as shown in Fig. 12-a, and the following assumptions were imposed:

- The failure occurs in one of the chords above or below the opening.
- The ultimate torsion capacity of the beam is the summation of the ultimate torsion of the two chords above and below the opening.
- The two chords above and below the opening rotate by the same angle.

The contribution of stirrups in resisting torque in the MVATM was derived for vertical stirrups. For inclined stirrups by angle α with the horizontal direction, the force in stirrups was analyzed to two components, one in a vertical direction (A_t F_t $sin\alpha$) and the another in the horizontal direction (A_t F_t $cos\alpha$) which was added to the force in the longitudinal bars (A_L F_L) as shown in Fig. 12-b.



a) Vertical stirrups



b) Inclined stirrups

Fig. 12. Simulation of a RC beam with web opening in MVATM

Calculation algorithm to obtain the torsional behavior for beams with different arrangements of reinforcements around web openings is shown in Fig. 13. The procedure can be epitomized in the following steps:

1- Select value of the compressive strain at the surface of concrete strut $\varepsilon_{ds} \leq 0.0035$.
2- Assume α=45º, and t_e=A_{oh}/p_h as initial value. Where A_{oh} is the area bounded by the centerline of the outermost closed stirrups, and P_h is the perimeter of the stirrups, then calculate β from Eq. (9).
3- Calculate K_1, σ_{cd}, T, ε_t, ε_l, and t_e`, from Eqs. (13), (7), (8), (1), (4), (5), and (3) respectively.
4- Compare t_e` with the assumed $t_e$. If the difference is close continue to step 5, else take the calculated $t_e$` in step 2.
5- Calculate α` from Eq. (2), then compare $\alpha$` with the assumed α.If the difference is close continue to step 6, else take the calculated α` in step 2.

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6- Calculate $\beta^{`}$ from Eq. (9), then compare $\beta^{`}$ with the assumed β.If the difference are close continue to step 7, else take the calculated $\beta^{`}$ in step 2.
7- Calculate θ, and T_{cref} from Eqs. (6), and (19).If $T \leq T_{cref}$, calculate K_t, and θ_{cor} from Eqs. (16) and (17), else go to step 8.
8- Calculate the correct values of θ from T_{cref} to T_u according to Eq. (20).
9- Repeat the previous steps with another value for ε_{ds}.

A computing procedure was carried out with program language MATLAB. Full theoretical *T-θ* curves were obtained for the solid specimen and the specimens with reinforcement around the opening. The comparison between the predicted and experimental *T-θ* curves of the tested specimens are shown in Fig. 14, which shows that the proposed model has a good agreement with the experimental results.

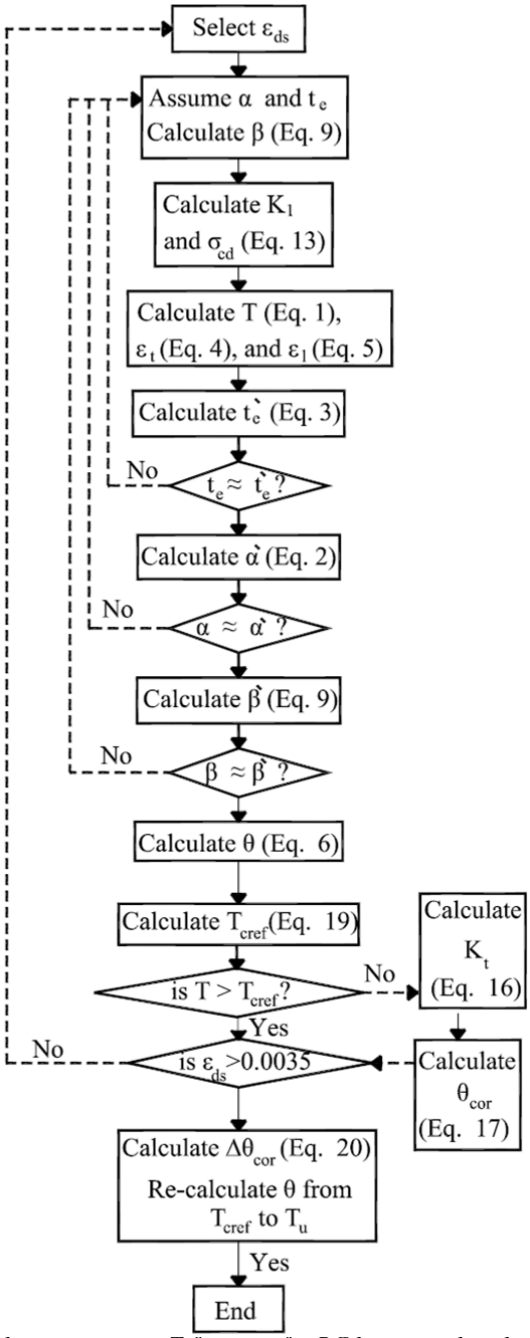

Fig. 13. Flowchart to compute T-θ curves for RC beams with web opening.

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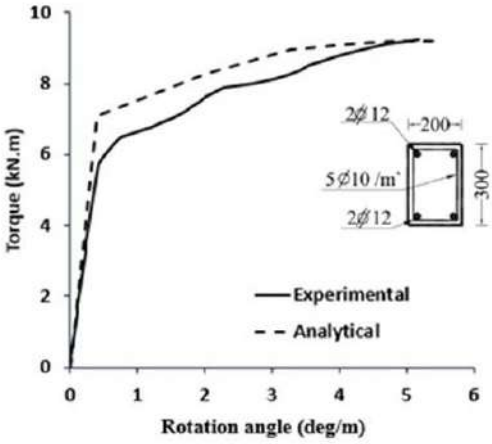
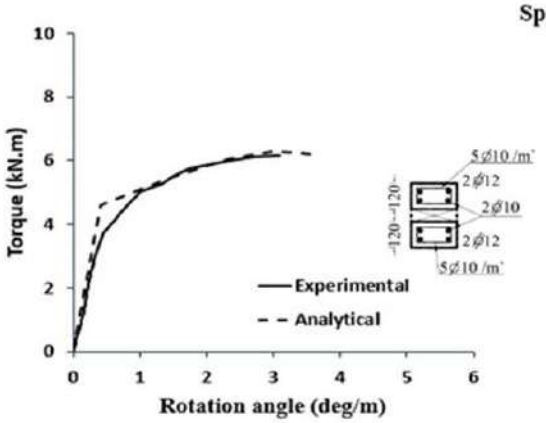
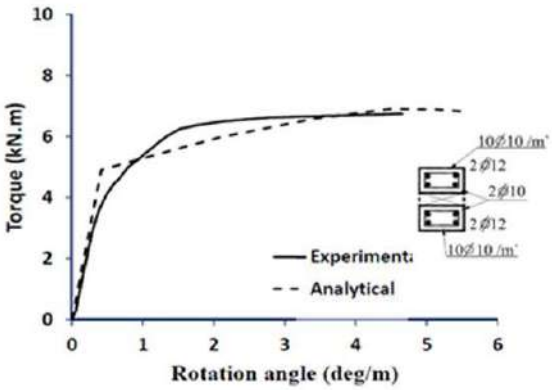


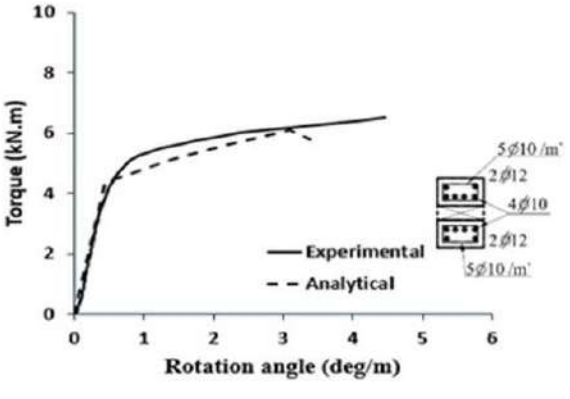
Specimen (S)



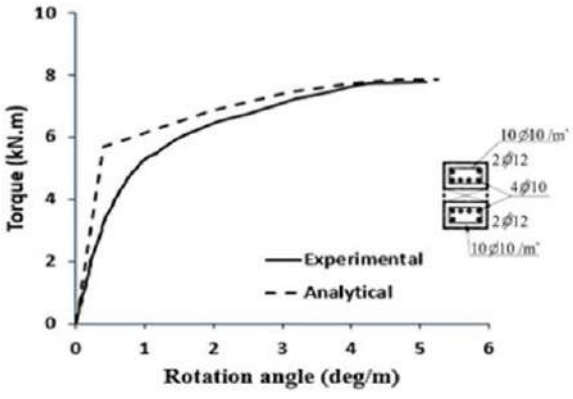
Specimen (R-2H-5V)



Specimen (R-2H-10V)



Specimen (R-4H-5V)



Specimen (R-4H-10V)

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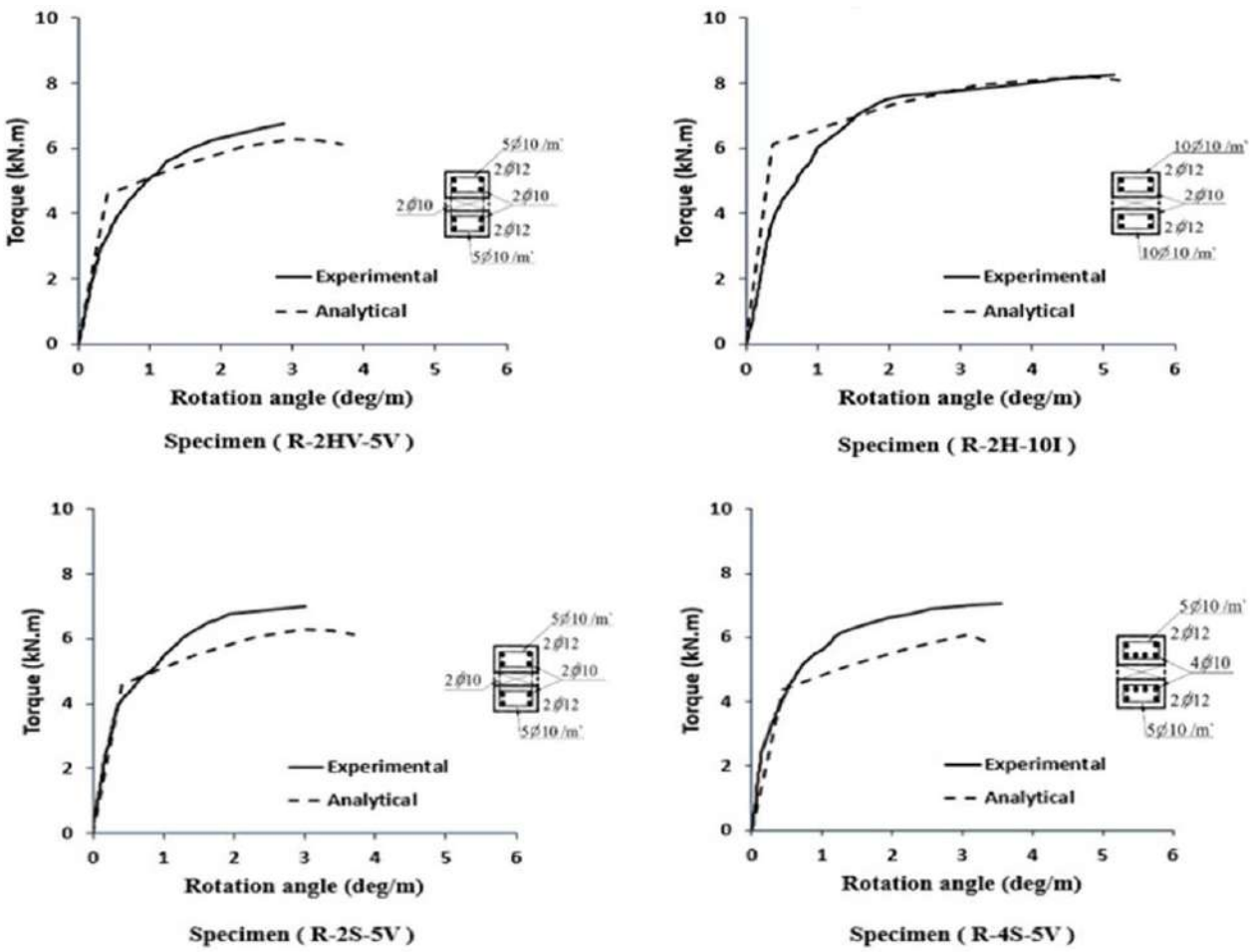

Fig. 14. Comparison between the analytical and experimental T-θ curves.

V. CONCLUSION

In this paper, the torsional behavior of RC beams with large web opening with and without reinforcement around the opening is investigated. An analytical model was presented to obtain the torque-rotation curves for beams with reinforcement around the opening. The validity of the model was verified through comparing the analytical torque-rotation curves with the test results. Based on the fifteen specimens that were tested under pure torsion the main conclusions are summarized as following:

- Diagonal cracks were spread out to perform a spiral trajectory inclined by 45º with the longitudinal axis of the tested specimens on the four sides with increasing the applied torque. For specimens without reinforcement around the opening, the cracks started at a corner of the opening and performed only in the chords above and below the opening, and the number of cracks was small. For specimens with reinforcement around the opening the number of cracks increased compared to the ones without reinforcement around the opening, and the cracks were presented in the solid parts of the specimens, in additional to the crakes in the chords above and below the opening.
- The geometrical parameters of the web opening effected on the behavior of the specimens without reinforcement around the opening. Doubling the opening depth was more effective in decreasing the cracking and ultimate torque than doubling the opening length. The torsional behavior was enhanced when the opening become eccentric in respect to the longitudinal axis of the beam, where for opening eccentricity 0.1 and 0.2 of the beam height, the cracking and ultimate load increased by 25-30% and 16-22% respectively.
- Installing reinforcement around opening notably enhanced the torsional behavior of the beams. Where, the ultimate torque for the specimen with inclined stirrups by 45º to the longitudinal axis of the specimens at the chords above and below the opening was 90% of that for the solid specimen.

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- Increasing the number of stirrups from 5Ø10/m to 10Ø10/m in the chords above and below the opening increased the cracking and ultimate load by 11-18% and 9-20% respectively.
- The cracking and ultimate torque increased 4-10% and 5-15%, respectively, with increasing the horizontal reinforcement above and below the opening from 2Ø10 to 4Ø10.
- Replacing closed stirrups around the opening by vertical and horizontal reinforcement bars had a minor effect on the torsional behavior.
- The proposed modifications on the Modified Variable Angle Truss Model (MVATM) is reliable for predicting the torque-rotation curve for beams with large web opening subjected to pure torsion. There was a good agreement between the predicted and experimental torque-rotation curves for tested specimens with reinforcement around the opening.

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Assessment of Food Safety and Sanitation Standards of Canteens in Nueva Ecija

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Abstract**—** *Food safety is a particularly worrying environmental health problem in universities. This study used descriptive method of research. A total of 172 respondents from different universities were surveyed.Findings in this study reported that adherence to school canteen rules and government regulations play important roles in influencing food handlers' attitude towards safe food handling. It was found that perceived barrier generally do not hinder safe food handling. However, small working space, inconvenient location for kitchen equipment and unavailability of food handling guideline toward achieving safe food handling were individual items in the questionnaire that scored high.*

Keywords**— School Canteens, Canteens, Food Safety, Food Sanitation, Safety Standard, Sanitation Standard.**

I. INTRODUCTION

Food safety is a particularly worrying environmental health problem in universities. Sharif et al. (2013) stated that improper food handling activity and lack of knowledge are contributing factors for the transmission of food borne outbreaks.

Furthermore, Yan (2012) explained that the magnitude of the potential danger has yet to be adequately understood, as demonstrated by the lack of a detailed account of the broader implications of food safety concerns and expectations of food risk.

Osimani et al. (2014) concluded that the implementation of punitive steps against bad hygiene, such as re-cleaning undesirable surfaces or replacing/regenerating damaged work surfaces.

Nee and Sani (2011) reported that the level of expertise of food handlers in this sample can be rated as fair with an average score of 57.8%. Thus, Zain and Naing (2002) recommended that Training, preparation, and the production of food safety certification exams are key components in ensuring that food handlers are qualified in and educated about the values of food safety and sanitation.

In light of the foregoing insights, the researcher's piqued its interest in the assessment of the food standards, in terms of safety and sanitation, if it was being complied by the food handles among the universities in Nueva Ecija.

II. CONCEPTUAL FRAMEWORK

According to Ababio and Adi (2012), the realistic dimension was not fully understood by the food handlers and they did not have any technical understanding of the procedures that could be performed to guarantee food safety.

Lee et al. (2017) reported that food handlers had a reasonable level of knowledge of food safety with a good attitude, and self-reported habits, the poor performance in hand hygiene appraisal showed an inability to regularly practice safe handling of food in their job.

Evidenced in the study of Meleko (2013), Poor accessibility and cleanliness of latrine service in some canteens and food handlers ' general hygiene routine portrays that most of them had poor practice of food handling.

III. OBJECTIVE OF THE STUDY

This paper described the food handlers and operations of canteen in their compliance to food safety standards andfood sanitation standards.

IV. METHODOLOGY

The study used descriptive method as it describes the present condition. As the main objective of this method is to describe practices that prevail; and beliefs and processes that are going on; effects that being felt or trends that are developing. (Cohen et al., 2002)

A total of 172 respondents from different universities were surveyed. The researcher used likert-scale type questionnaire

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(Vagias, 2006) and analyzed it through statistical data treatment such as mean and weighted mean.

V. RESULTS AND DISCUSSION

Table 1. Food Safety Standards

Standards	WM	Verbal Interpretation
Tied hair while preparing foods.	3.28	Always
Wearing clean protective clothing.	0.54	Never
Washing hands thoroughly with warm soapy water.	3.60	Always
Cold foods are kept 5◦C or below.	3.88	Always
Hot foods are kept 60◦C or below.	3.68	Always
Foods are 60◦C or above	3.48	Always
Covering or removing jewelry that may contaminate food.	3.68	Always
Ready to eat foods are covered and stored above veg. And meat in a fridge.	3.52	Always
Raw meat are kept in sealed containers in the bottom or the fridge.	3.52	Always
Use tongs, spoons, bags, or paper to serve unpacked foods.	3.52	Always
Average Weighted Mean	**3.27**	**Always**

Table 1 presents the food practices of the respondents according to food safety standards. The statement "Cold foods are kept 5◦C or below" hadthe highest weighted mean of "3.88" with an interpretation of "Always". On the other hand, the statement "Wearing clean protective clothing" had the lowest weighted mean of "0.54" and an interpretation, "Never."

Table 2. Food Sanitation Standards

Standards	WM	Verbal interpretation
Tables and chairs are clean permanently installed.	3.44	Always
Having good personal hygiene (shorts fingernails without painting) during handling food.	3.64	Always
Cooked foods are displayed in cabinet that can facilitate consumer to see the food.	3.56	Always
Using ladle or spoon with a long handling for serving.	3.60	Always
Cooking and eating utensils are sterilized.	3.60	Always
Changing chopping board and utensilseverytime you prepare new type of food.	3.52	Always
Non- smoking while preparing foods.	3.68	Always
Foods are free from pest and vermin.	3.52	Always
Disposing of garbage regularly.	3.68	Always
Average Weighted Mean	**3.57**	**Always**

Table 2 presents the practices of respondents according to food sanitation standards. The statement "Changing chopping board and utensils every time you prepare new type of food", "Non- smoking while preparing food", and "Disposing of garbage regularly" had the highest weighted mean of "3.68%" and wereinterpreted as "Always". On contrary, gaining the lowest weighted mean of "3.44%" with an interpretation of "Always" was the statement, "Tables and chairs are clean permanently installed."

VI. CONCLUSION

Findings in this study reported that adherence to school canteen rules and government regulations play important roles in influencing food handlers' attitude towards safe food handling. It was found that perceived barrier generally do not hinder safe food handling. However, small working space, inconvenient location for kitchen equipment and unavailability of food handling guideline toward achieving safe food handling were individual items in the questionnaire that scored high. In addition, not only school canteens food handlers but also all of the food handlers should be given more awareness on food safety and hygiene practices and personal hygiene to prevent outbreak and spread of food-borne diseases to customers especially for students and teachers.

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Assessment of Tourism industry in Nueva Ecija

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Abstract*— *Tourism plays an important role in establishing a nation like the Philippines and serves as one of the state's contributor. A total of 205 tourist respondents were surveyed from different tourist spots in Nueva Ecija. Descriptive method of research was used. Also, the researcher used likert-scale type questionnaire and analyzed the data through statistical data treatment such as mean and weighted mean. In light of the foregoing results, the researcher concluded that the tourist spots in Nueva Ecija greatly appealed its visitors through its uniqueness, historical value and natural aesthetics and were evaluated as "Excellent." Thus, the accessibility to these tourist spots was evaluated as "Fair."Further, the difficulties and problems encountered by tourists, in terms of "Transportation" was evaluated as "Fair." Thus, the areas for the development of tourism should focus more on improving the aspect transportation than tourism service facility as this aspect was evaluated as "Excellent."

***Keywords*— Tourism, Tourist Spots, Assessment, Tourist Industry.**

I. INTRODUCTION

Tourism plays an important role in establishing a nation like the Philippines and serves as one of the state's contributor. Lickorish and Jenkins (2007) stated that the government has often played a supporting but largely background role in the development of tourism, particularly in the developed countries. Further, Rodolfo (2009) cited as one of tourism's benefits is that the achievement of tourism development will heighten their national identity and sense of unity.

According to Said (2008), tourist spots boasts environmental features that cater to ecotourism, maritime as well as community-based tourism, so steps must be taken to conserve its infrastructure and culture that can potentially be lost if no effort is made to protect such attractions.

Aguda et al. concluded that the respondents accepted that the impacts of tourism on tourist spots in province are financial, economic, political, educational, heritage and the arts. Thus, De Vera (2019) revealed that the tourist definition of what is the optimal distance and space to another unknown tourist can be decreased as shown in the effects of the tourists ' measured limits and real maps, thereby minimizing the tourists ' social and public spaces.

Celis et al. (2013) concluded that the prospect of tourism attraction business development is high, as people's love for travel and tours will remain a part of their psyche. Likewise, Ylagan and Laguador (2014) suggested that each municipality's Local Government Units improve the tourism development programs in collaboration with the private sectors.

In view of these insights, the researcher wanted to assess the tourism in Nueva Ecija as the province is home to different tourist spots such as Minalungao, and other mountain scenic spots.

II. CONCEPTUAL FRAMEWORK

According to Jian-ying (2007), Tourism assets values include importance of tourism, value of scientific research, historical culture and value of education, value of the environment, value of the opportunity, value of the heritage and value of life.

Su and Wall (2010) concluded that most respondents agreed that encounters with local people have an effect on their destination perceptions, the nature of their visits, potential destination choices and on-site purchases, particularly those with higher education and a younger age.

Further, Aguila and Ragot (2014) concluded that building roads and bridges can help to boost a province's ecotourism industry as it can help improve access to the tourist destination.

III. OBJECTIVES OF THE STUDY

The study described the assessment of tourist spots in Nueva Ecija in terms of appeal, accessibility, activities and products, and, facilities and services. This paper also described the difficulties and problems encountered by the tourists in terms of transportation, tourism service facilities, accommodation establishments and infrastructure.

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IV. METHODOLOGY

The study used descriptive method as it describes the present condition. The main objective of the study is to explore the causes of particular phenomenon with effects that being felt or trends that are developing. (Cohen, Manion, Morrison, 2002)

A total of 205 tourist respondents were surveyed from different tourist spots in Nueva Ecija.The researcher used likert-scale type questionnaire (Vagias, 2006) and analyzed it through statistical data treatment such as mean and weighted mean.

V. RESULTS AND DISCUSSION

Table 1. Tourist Spots' Appeal

Statements	Weighted Mean	Verbal Interpretation
The tourist spots do not have similarities to other province's tourist spot. (Uniqueness)	3.52	Strongly Agree
The tourist spots have been well-preserved for its years of existence. (Historical Value)	3.42	Strongly Agree
The inhabitants of the tourist spots preserve their tradition and customs. (Socio-Cultural Value)	3.09	Agree
The tourist spots were preserved with its nature beauty and not enhanced with modern day construction materials. (Natural Aesthetic)	3.34	Strongly Agree
There were 100,000 and more tourists/visitors per annum tallied in the tourist spots of the province. (Presence of Visitor Traffic)	2.81	Agree
Total Weighted Mean	3.24	Strongly Agree

Table 1 presents that the statement, "The tourist spots do not have similarities to other province's tourist spot" which represents Uniqueness got the highest weighted mean of 3.52 with verbal interpretation, "Strongly Agree." While the statement, "There were 100,000 and more tourists/visitors per annum tallied in the tourist spots of the province" which represents the presence of visitor traffic got the lowest weighted mean of 2.81 with verbal interpretation, "Agree."

Table 2. Tourist spots' Accessibility

Statements	Weighted Mean	Verbal Interpretation
The tourist spots were approximately 10 km from the high way or developed roads. (Distance)	2.54	Agree
The travel time for tourist spots were within an hour from a nearby city. (Travel Time)	2.57	Agree
The road is made of asphalt or concrete or any similar materials that will not result to unpaved surface. (Type of Road)	1.44	Strongly Disagree
There are vehicles available anytime of the day that are exclusively for tourist spots. (Means of Transport)	1.95	Disagree
Total Weighted Mean	2.13	Disagree

Table 2 presents that the statement, "The travel time for tourist spots were within an hour from a nearby city" which represents Travel Time got the highest weighted mean of 2.57 with verbal interpretation, "Agree." While the statement, "The road is made of asphalt or concrete or any similar materials that will not result to unpaved surface" which represents the type of roadgot the lowest weighted mean of 1.44 with verbal interpretation, "Strongly Disagree."

Table 3. Tourist spots' Products and Services

Statements	Weighted Mean	Verbal Interpretation
There were four or more tourism activities available on a certain tourist spot.	3.38	Strongly Agree
There were four or more varieties of products offered on a certain tourist spot.	2.74	Agree
There were 6 or more facilities available for tourists/visitors on a certain tourist spot.	2.11	Disagree
There were 6 or more services offered for tourists/visitors on a certain tourist spot.	2.18	Disagree
Total Weighted Mean	2.60	Disagree

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Table 3 presents that the statement, "There were four or more tourism activities available on a certain tourist spot" got the highest weighted mean of 3.38 with verbal interpretation, "Strongly Agree." While the statement, "There were 6 or more facilities available for tourists/visitors on a certain tourist spot." which represents the presence of visitor traffic got the lowest weighted mean of 2.81 with verbal interpretation, "Disagree."

Table 4. Summary Mean Ratings of Tourist Spot Evaluation

	Weighted Mean	Verbal Interpretation
Tourist Appeal	3.24	Excellent
Accessibility	2.13	Fair
Availability of products and services	2.60	Good
Total Weighted Mean	2.66	Good

Table 4 presents the summary mean ratings of tourist spot evaluation. The tourist appeal got the highest weighted mean of 3.24 with verbal interpretation, "Excellent." While the accessibility for tourists got the lowest weighted mean of 2.13 with verbal interpretation, "Fair."

Table 5. Transportation (Area of Development)

Transportation	Weighted Mean	Verbal Interpretation
The travel time from airport or seaport to a tourism center or town is less than an hour.	1.44	Strongly Disagree
There is a well-established airport or main seaport that can expand easily for future.	1.89	Disagree
The transport services at airport or main seaport meet international standard and operation.	2.04	Disagree
The conditions of road from town to a tourism center is paved and more than 7m-wide carriageway.	2.73	Agree
Total Weighted Mean	2.03	Disagree

Table 5 presents that the statement, "The conditions of road from town to a tourism center is paved and more than 7m-wide carriageway" got the highest weighted mean of 2.73 with verbal interpretation, "Agree." While the statement, "The travel time from airport or seaport to a tourism center or town is less than an hour" got the lowest weighted mean of 1.44 with verbal interpretation, "Strongly Disagree."

Table 6. Tourism Service Facility (Area of Development)

Tourism service facility	Weighted Mean	Verbal Interpretation
There were guide signs and information board provided along the road for tourists.	3.75	Strongly Agree
There is an information center with shops and comfort rooms at the tourism center or town.	3.26	Strongly Agree
There were a more than 500 rooms in total of accommodation establishments for tourists.	2.83	Agree
Total Weighted Mean	3.28	Strongly Agree

Table 6 presents that the statement, "There were guide signs and information board provided along the road for tourists" got the highest weighted mean of 3.75 with verbal interpretation, "Strongly Agree." While the statement, "There were a more than 500 rooms in total of accommodation establishments for tourists" got the lowest weighted mean of 2.83 with verbal interpretation, "Agree."

Table 7. Infrastructure (Area of Development)

Infrastructure	Weighted Mean	Verbal Interpretation
There is a water supply/water resource/ water plant nearby tourism spots or town.	3.42	Strongly Agree
There is an operating sewerage system and solid waste collection nearby tourism spots or town.	3.16	Agree
There is a power supply/power plant nearby tourism spots or town.	3.10	Agree
All means of telecommunication are available nearby tourism spots or town.	2.87	Agree
Total Weighted Mean	3.13	Agree

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Table 7 presents that the statement, "There is a water supply/water resource/ water plant nearby tourism spots or town" got the highest weighted mean of 3.42 with verbal interpretation, "Strongly Agree." While the statement, "All means of telecommunication are available nearby tourism spots or town" got the lowest weighted mean of 2.87 with verbal interpretation, "Agree."

Table 8. Summary of Mean Ratings of Tourism Areas for Development

	Weighted Mean	Verbal Interpretation
Transportation	2.03	Fair
Tourism Service Facility	3.28	Excellent
Infrastructure	3.13	Good
Total Weighted Mean	2.81	Good

Table 8 presents the summary mean ratings of tourism areas for development. Tourism service facility got the highest weighted mean of 3.28 with verbal interpretation, "Excellent." While the transportation for tourists got the lowest weighted mean of 2.13 with verbal interpretation, "Fair."

VI. CONCLUSION

In light of the foregoing results, the researcher concluded that the tourist spots in Nueva Ecija greatly appealed its visitors through its uniqueness, historical value and natural aesthetics and were evaluated as "Excellent." Thus, the accessibility to these tourist spots were evaluated as "Fair." The researcher recommends that the government sector should focus on road development to increase in propagation of tourism.

Further, the difficulties and problems encountered by tourists, in terms of "Transportation" was evaluated as "Fair." Thus, the areas for the development of tourism should focus more on improving the aspect transportation than tourism service facility as this aspect was evaluated as "Excellent."

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The Effect of Service Quality on Patient Loyalty (A Study on Inpatients of Regional Public Hospitals in Jakarta, Indonesia)

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Abstract**—***This study aims at examining whether service quality influences customer loyalty, in this case, hospital's inpatient. Service quality is represented in the form of five independent variables, which are tangibles, reliability, responsiveness, assurance, and empathy. This study is conducted at some regional hospitals in Jakarta, Indonesia, and the respondents are inpatients of the concerned hospitals. The data are analyzed by employing a multiple linear regression method. The research shows that the five independent variables simultaneously, significantly influence patient loyalty. Partially, almost all of the independent variables significantly influence it except the reliability variable.*

Keywords**—** ***Service quality, tangibles, reliability, responsiveness, assurance, empathy, patient loyalty***.

I. INTRODUCTION

Indonesia's current Health Spending per Capita is still far lower than that of developed countries, even still below that of neighboring Asean countries such as Thailand, Malaysia and, moreover, Singapore. The total percentage of health spending is still about 3.3% of Indonesia's GDP or one of the lowest in Asean (Health SDG Profile, 2018). One of the reasons is the lack of hospitals, both in quantity and quality. The ratio of Indonesia's hospital bed to patient is currently about 1:900, compared to the average ratio of ASEAN countries of 1:303 (Nurcahyadi, 2016). However, in the last few years, there is a promising growth in the quantity. The data show an average growth of 5.2% of the number of hospitals in Indonesia since 2012. There are 2820 identified hospitals in April 2018, consisting of 1804 units owned by Private sector and 1016 units owned by the Government (Trisnantoro *et al*., 2018). The growth also occurs to the number of hospitals in DKI Jakarta province as the state capital, from 159 units in 2014 to 187 units in 2017 (Profil DKI, 2017). It is reasonable that Jakarta's population increases, either its permanent, urban or immigrant population for employment or business. The need for urban health service keeps increasing that people's awareness of the importance of health also improves.

Business competition is currently not only correlated with product's physical form, but also "before and after sales service" (Sivadas *et al*., 2000). The role of service quality is acknowledged to be a critical determinant for a company's success. Bad service will decrease customer satisfaction level, moreover, current consumers are more aware of rising standards in service which have developed higher expectations. Service quality will cause customer satisfaction, retention, repurchase, customer loyalty, and even market share and profitability (Tjiptono, 2019). This rule is also felt in hospital industry, which is in a more competitive environment. Hospital is an organization which sells health services. Competition in maintaining customers is not only influenced by the availability of physicians and ease of payment, but also by the quality of all services provided to patients. Patient satisfaction is closely related to the quality of services provided by hospital (Kurniawan *et al*., 2019). Patient satisfaction will then lead to loyalty. On the contrary, dissatisfied patient will move to another hospital which provides better services.

By management, hospital may be classified into: (1) public hospital, managed by the government and nonprofit legal entity, (2) private hospital, managed by legal entity with profit orientation. Various types of existing hospitals attempt to acquire the community's trust by giving quality health services. Such health services include medical service, medical support, medical rehabilitation and treatment service. The services are performed through emergency unit, outpatient unit, and inpatient unit

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(Herlambang, 2016). There are relatively many government-owned hospitals in Jakarta, consisting of 3 central public hospitals (RSUP) and 25 regional public hospitals (RSUD) (http://sirs.yankes.kemkes.go.id/). In the report of survey on the Community Satisfaction Index issued by the Indonesian Ministry of Health 2017, the community is satisfied with services given by RSUP. Moreover, according to the analysis on Consumer Loyalty, more than 80% users answer that they are likely to reuse the concerned hospitals' services, and above 90% users answer that they will recommend the hospitals to others. However, the impression of RSUD is different. Regional public hospitals have relatively limited facilities and infrastructure as well as the availability of human resources. However, in comparison with private hospitals at the same level, RSUDs need to improve their service quality.

In this study, the survey is conducted with regional public hospitals in Jakarta managed by local governments, with inpatients treated in some of the hospitals as the research's subjects. For the inpatients, satisfaction level is influenced from registration process, medical action at emergency unit, cleanliness and comfort of treatment room, medical staff and paramedic's attitude and behavior, to the quality of meal given to patient (Setiawan, 2011). In detail, the purpose of this study is to examine and analyze whether Health Service Quality given by regional public hospitals influences Inpatient Loyalty at the concerned hospitals.

II. LITERATURE REVIEW

2.1 Service Quality

Service quality is deemed as strategic weapon in a service oriented industry, as well as a source of competitive advantage. Parasuraman *et al*. (1985) define Service Quality as a global assessment or attitude with regard to a service's superiority. He emphasizes that the two main factors to influence service quality are expected service and perceived service. Wyckof (in Lovelock (1988)) describes service quality as the expected level of advantage and control over such advantage in meeting customer's expectation. According to Bitner and Hubbert (1994, in Kondasani *et al*. (2015)), service quality is the consumer's overall impression of the relative inferiority/ superiority of the organization and its services. In healthcare sector, particularly in hospital industry, service quality is generally viewed as an outcome. Services given by a hospital may be divided into medical and non-medical aspects. The medical aspect includes its supports, consisting of human resources, both in quantity and quality, as well as various instruments for disease diagnosis and treatment purpose. Non-medical aspect consists of information, administration, finance, nutrition, pharmacy, cleanliness and security of hospital environment services (Gonzales in Zulhafiqi (2014)).

The concept of service quality itself has actually developed since 1970. Various opinions arise, such as that of Gronroos (1984), that there are two attributes related to service quality, which are technical and functional aspects. Technical aspect is a process related to the quality of equipment, duty timings, prescription etc., while functional aspect is related to the routine operations, including interaction with customers. A good service quality will certainly raise customer satisfaction, and Kotler *et al*. (2006) remind that the managements must be concerned about the four service characteristics, including: intangibility, perishability, inseparability, and heterogeneity. Evans and Lindsay (2012, in Afridi *et al*. (2018)) introduce eight dimensions of service quality, including: time, timeliness, completeness, courtesy, consistency, accessibility, accuracy and responsiveness. Buyukozkan *et al*. (2011) describe healthcare service quality in six dimensions, including: tangibles, responsiveness, reliability, assurance, empathy and professionalism. Many researches on health industry prove that Service Quality significantly influences patient satisfaction and loyalty. The research conducted by Shabbir *et al*. (2016) on hospital industry in Pakistan proves that perceived service quality has a significant positive effect on patients' loyalty. Their research is conducted on inpatients of both public and private hospitals. Meanwhile, the research conducted by Kaffashi *et al*. (2014) on outpatients finds relationship between outpatient service quality and patients' loyalty in selected public hospital in Iran. A similar result is also reported by the research conducted by Fatima *et al*. (2018), proving that healthcare service quality aspects (physical environment, customer-friendly environment, responsiveness, communication, privacy and safety) are positively related with patient loyalty which is mediated through patient satisfaction. With regard to the influence of an increase of service quality on satisfaction and loyalty, the research conducted by Ping Lei *et al*. (2012) on Chinese healthcare system shows that the most appropriate model to describe this situation is that service quality will influence loyalty mediated by satisfaction variable.

The popular service quality model often referred to in marketing researches is the SERVQUAL model (abbreviation of service quality), developed by Parasuraman *et al.* (1985). The model includes analysis on 5 gaps which will determine how good a company's

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service quality is. The five gaps may be broken down as follows (Tjiptono, 2019): (1) gap between consumer's expectation and management's perception of customer's expectation (knowledge gap), (2) difference between management's perception of consumer's expectation and service quality specification (standards gap), (3) difference between service quality specification and service delivery (delivery gap), (4) difference between service delivery and external communication (communications gap), and (5) gap between perceived service and expected service (service gap). The fifth gap is represented through customer's perspective on the five dimensions of service quality. Parasuraman *et al.* (1988, in Tjiptono (2019) propose the servqual model to assess service quality, in which the model contains five main dimensions, namely:

1. Reliability; is the ability to provide promised service immediately, accurately and satisfactorily.
2. Responsiveness; is staffs' desire to help customers and provide services responsively.
3. Assurance; covers staffs' knowledge, competence, politeness and trusted characteristics, and free from risk and doubt.
4. Empathy; is the ability to have a good relationship and communication, personal attention and understanding of customers' needs.
5. Tangibles; includes physical facilities, equipment, employees and means of communication.

Initially, using Factor analysis, Parasuraman *et al.* successfully identify 10 dimensions out of the 22 questions asked in evaluating service quality. After passing empirical test, the servqual model is modified to 5 dimensions only. In this study, the author employs the servqual model with five dimensions above, with research instrument modified by James Carman to be specifically applied to hospital industry (Zaim *et al*., 2010).

2.2 Customer Loyalty

Many companies start to be aware that customer satisfaction is not their final objective, moreover, many competitors provide customers with many alternative suppliers. Satisfaction is an individual's attitude, while loyalty is buying behavior. A loyal customer is an individual that makes regular repurchase, invulnerable to any of competitor's persuasion, and even willing to recommend the concerned product to others. Therefore, customer satisfaction will be meaningful when it leads to Customer Loyalty. According to Schnaars (1998), there are four possibilities of relationship between customer satisfaction and loyalty, namely: (a) failures, in which customer is dissatisfied and disloyal; (b) forced loyalty, dissatisfied but bound to promotional program, as if it is loyal; (c) defectors, customer is satisfied but disloyal; (d) successes, customer is satisfied, loyal and may serve as a word-of-mouth advertiser. Fornell (1992, in Ahmed *et al.* (2017)) states that loyal customers are not necessarily satisfied, but satisfied customers must be loyal customers. Yarmen *et al.* (2016) in their research define loyalty as customer commitment on still using a certain service provider even though he/she has opportunity and resources to switch to other providers. Griffin (2005) represents customer loyalty as a more reliable measure than customer satisfaction factors to predict company's sales growth. Gelis *et al*. (2017) describe loyal customer as a person who regularly uses a service provider or vendor, repeats to purchase of service or product from the same corporate and does not consider other service providers or vendors. Bowen and Shoemaker (2003) state that loyalty is the attitude of a customer towards a specific company who purchases again and again from the same company, and talks good about the company and provide referrals.

With regard to the health and hospital industry, Engiz (2007, in Asnawi (2019)) describes patient loyalty as the situation that the patient continues the relation with the hospital and recommends the services of the hospital to the potential patients. Anbori *et al.* (2010, in Ahmed *et al.* (2017)) represent patient loyalty as a strategic service plan to retain customers in the long term by providing better service quality. When a service provider understands the most important aspects of service quality needed by patients, then this will lead to patient satisfaction and willingness to reuse medical services. Many researches correlate service quality with patient loyalty. The study conducted by Gunawan *et al.* (2011) with private hospitals in Bali, Indonesia confirms significant influence, both simultaneously and partially, of service quality on patient loyalty. In the study, Parasuraman *et al.*'s concept (1985) is used for the indicators of service quality variable, while the concept in Baloglu's study (2002) is used for the indicators of loyalty variable, namely: trust, psychological commitment, switching cost, word of mouth, and cooperation. Similar result is also obtained in the study conducted by Asnawi *et al.* (2019), that a public hospital's service quality will directly influence patient's satisfaction and loyalty. The research conducted by Putu *et al.* (2018) at a hospital confirms positive and significant influence of service quality on patient loyalty. Putu *et al.* even find indirect influence between the two variables above mediated by patient satisfaction. This is slightly different from the result of research conducted by As'ad and Noermijati (2011) on a hospital with inpatients as the sample. Service quality variable here does not directly influence patient loyalty, but through customer satisfaction

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variable instead. The study conducted by Afridi *et al.* (2018) in Peshawar finds significant influence of healthcare quality on patient loyalty. The study also reveals that customer's commitment presents a mediating effect on the correlation of the two variables above. Arab *et al.* (2012) conduct a study to determine the hospital service quality from the patients' viewpoints and the relative importance of quality dimensions in predicting the patient's loyalty. It turns out that 29% loyalty variance is explained by service quality dimensions.

Setiawan (2011) presents some factors which may form customer loyalty in hospital industry, namely: (a) customer's sense of belonging through product preferential and differential level; (b) develop switching barrier, through switching cost aspect and social and psychological aspects; (c) generate service quality which may satisfy customer. Meanwhile, Kumar and Shah (2006) divide loyalty into behavioral and attitudinal aspects. Behavioral loyalty refers to the buying characteristics of a buyer, while attitudinal loyalty, on the other hand, is considered to be the pure form of loyalty. Baloglu (2002) introduces five indicators of loyalty, namely: (1) trust, (2) psychological/ emotional commitment, (3) switching cost, (4) word of mouth, and (5) cooperation. The five indicators are actually the detail of behavioral and attitudinal dimensions. Behavioral dimension is sometimes called voluntary partnership, measured through cooperation and word-of-mouth indicators. Cooperation is defined as working together to achieve mutual goals, and it is usually customer's desire to help the concerned company or product. Meanwhile, word-of-mouth involves promoting the company by making positive statements, recommendations, and referrals. Attitudinal dimension measures loyalty through the following indicators: trust, emotional attachment or commitment, and switching cost. Trust may be defined as one's confidence in an exchange partner's reliability and integrity. Emotional attachment or commitment has been defined as liking the partner, enjoying the partnership, and having a sense of belonging to the company. Switching has been defined as the time, effort, and expense associated with switching from one company to another.

2.3 Conceptual Framework and Hypothesis

In answering the research's objective, a research model which involves Service Quality variable as the independent variable and Customer Loyalty variable is developed, which in this case is Patient Loyalty, as the dependent variable. Parasuraman *et al.*'s servqual model with 5 dimensions (1988) is employed to represent Service Quality variable. The five dimensions are taken as the five independent variables, which may operationally defined as follows: (1) Reliability, is the ability to provide promised service accurately and satisfactorily; (2) Responsiveness, is staffs' desire to help customers and provide services responsively; (3) Assurance, covers staffs' knowledge, competence, politeness and trusted characteristics, and free from risk and doubt; (4) Empathy, is the ability to have a good relationship and communication, personal attention and understanding of customers' needs; (5) Tangibles; includes physical facilities, equipment, employees and means of communication. Meanwhile, the Customer Loyalty variable may be defined as a multi-element concept involving both behavioral elements (repeat purchases) and attitudinal elements (commitments). This study employs Baloglu's approach (2002) which introduces five indicators of loyalty, namely: (1) trust, (2) psychological/ emotional commitment, (3) switching cost, (4) word of mouth, and (5) cooperation.

Based on the literature review and research model above, five hypotheses H1 to H5 are developed, showing partially significant influence of respectively independent variables (Tangible, Reliability, Responsiveness, Assurance, Empathy) on dependent variable (Customer Loyalty). And, the sixth hypothesis (H6) shows simultaneously significant influence of independent variables on Customer Loyalty variable.

III. RESEARCH METHOD

This research is conducted at government-owned hospitals called RSUDs in DKI Jakarta province. According to the record, there are currently 25 RSUDs in Jakarta, 6 units in Central Jakarta, 4 units in West Jakarta, 6 units in South Jakarta, 5 units in East Jakarta and 4 units in North Jakarta. A quantitative method and explanative approach are employed for the analysis, aiming at explaining whether or not some independent variables influence the dependent variable. The samples are taken from the inpatients of three Class A and B regional public hospitals representing Central Jakarta, East Jakarta, and North Jakarta, while 100 respondents are taken out of the inpatients with a convenience sampling method.

Questionnaire is employed as the research instrument to represent the Service Quality variable using the instrument developed by James Carman (Zaim *et al.*, 2010), which is specifically applied to hospital industry. The instrument actually involves six dimensions of service quality, including the 'courtesy' dimension, containing 34 questions. However, this study only utilizes five dimensions of servqual, which are the independent variables (tangible, reliability, responsiveness, assurance, and empathy) containing 29 questions. Meanwhile, the

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customer loyalty variable uses Baloglu's version of indicators (2002) containing 19 questions. A complete test of the research's instrument consisting of validity and reliability test is conducted before data collecting. A multiple linear regression analysis is conducted on the data after meeting the data quality requirement to examine whether or not independent variables influence the dependent variable. F test and t test are employed for hypothesis test.

IV. RESEARCH FINDINGS AND DISCUSSION

The respondents' profiles may be classified by gender, age, education, employment, and duration of hospitalization. According to the collected data, 69 percent of the respondents are women and only 31 percent are men. By age, most of the respondents, 58 percent, are under 25 years old, 17 percent are above 51 years, and the remaining are 26-51 years old. In this research, most of the respondents, 69 percent, coincidentally have High School/Vocational High School education. The other interesting factor is that most of the respondents, 59 percent, are coincidentally unemployed or not yet employed, while the remaining are private employees, entrepreneurs, and housewives. The respondents are deemed relevant to assess the service quality factor, since most of them, 61 percent, has been hospitalized for 4-6 days, 8 percent for 7-15 days, 5 percent more than 15 days, and 26 percent for less than 3 days.

Meanwhile, the data processing using the multiple regression technique results in the outcome as presented in the table below.

Table 1. Result of Multiple Regression Analysis

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.892[a]	.796	.785	3.768

a. Predictors: (Constant), Var_X5, Var_X2, Var_X1, Var_X4, Var_X3

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	5214.271	5	1042.854	73.458	.000[b]
	Residual	1334.479	94	14.197		
	Total	6548.750	99			

a. Dependent Variable: Var_Y
b. Predictors: (Constant), Var_X5, Var_X2, Var_X1, Var_X4, Var_X3

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	6.686	3.285		2.036	.045
	Var_X1	.611	.133	.330	4.599	.000
	Var_X2	.319	.210	.111	1.519	.132
	Var_X3	.332	.157	.172	2.111	.037
	Var_X4	.933	.250	.281	3.736	.000
	Var_X5	.908	.390	.148	2.329	.022

a. Dependent Variable: Var_Y

The data processing result shows that R square value is 0.892, which means that the percentage of contribution of Tangible (X1), Reliability (X2), Responsiveness (X3), Assurance (X4), and Empathy (X5) variables' influence on Customer loyalty is 89.2%, while the remaining 10.8% is contributed by other variable not included in this research. This result may be interpreted that hospital's service quality factor (in the form of five dimensions of servqual) plays an important role in determining patient loyalty, particularly for inpatients.

The F count value is 73.458 with significance value of 0.000 < 0.05, thus we may conclude that Tangible, Reliability, Responsiveness, Assurance, and Empathy variables simultaneously, significantly influence In-Patient Loyalty. This means that the sixth hypothesis is acceptable. This finding is similar to that of previous researches considerably conducted particularly with regard to hospital industry (Shabbir *et al.* (2016), Jamaluddin *et al.* (2017), Fatima *et al.* (2018), Arab *et al.* (2012), Putu *et al.* (2018)). Indeed, not all of the researches represent service quality variable through the servqual's 5 dimensions: Tangible, Reliability, Responsiveness, Assurance, and Empathy. In the research conducted by Shabbir *et al.* (2016), Healthcare Service Quality variable is represented through physicians care, nurses' care, supportive staff, operational activities, and physical maintenance dimensions. The research conducted by Fatima *et al.* (2018) employs physical environment, customer-friendly environment, communication, privacy and safety, and responsiveness to represent healthcare service quality. On the other hand, the research conducted by Arab *et al.* (2012) represents hospital service quality through process quality, interaction quality, environment quality, and costing variables. Meanwhile, the research conducted by As'ad *et al.* (2011) entitled the influence of service quality and price on customer satisfaction and loyalty, with inpatients as the respondents finds no indirectly significant influence of service quality on patient loyalty.

This study partially finds that four out of the five independent variables, namely Tangibles (X1), Responsiveness (X3), Assurance (X4), and Empathy (X5) variables evidently significantly influence Customer Loyalty variable, as shown with their significance values which are below 5% of 0.000 for X1, 0.037 for X3, 0.000 for X4, and 0.022 for X5. This means that the first, third, fourth and fifth hypotheses are acceptable. Meanwhile, Reliability variable (X2) does not partially, significantly influence Customer Loyalty, as shown with the significance value of 0.132 > 0.05. We may state that the second hypothesis is rejected. This finding is in line with

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the result of research conducted by Kondasani *et al.* (2015) that one of the dimensions of perceived service quality studied, which is Reliability, evidently does not significantly influence customer loyalty. The study conducted by Kaffashi *et al.* (2014) on outpatient respondents shows the highest gap between perception and expectation with the Reliability dimension representing health service quality. In addition, the result of data analysis shows that Tangibles variable has the most dominant influence among the service quality's variables. This finding is possibly related to respondents' profiles, that they pay attention more to tangibles factor. Most of the respondents are young, under 25 years old, have High School or Vocational High School education, and are coincidentally mostly unemployed yet.

V. CONCLUSION

The result of data analysis shows that all of the hypotheses are acceptable, except the second hypothesis, showing that Reliability variable does not significantly influence Customer Loyalty. Meanwhile, the other variables of Service Quality such as Tangible, Responsiveness, Assurance, and Empathy partially, significantly influence Customer or Patient Loyalty. The five variables of Service Quality simultaneously, significantly influence Patient Loyalty.

The research result cannot be separated from the samples taken, in which the samples are inpatients of some class A and B regional public hospitals, which are hospitals which are relatively able to provide better services. The respondents' profiles also contributively influence the research result. For a result which may represent the actual condition better, it needs to increase the size of samples and involve more regional public hospitals in Jakarta.

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Assessment of Local Government Units (LGUS) of Bongabon in Manpower and Training Development

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Abstract**—** *Development of human resources plays a tremendous role in prompting valuable programs for people's needs in the community. The study used descriptive method. A total of 50 respondents composed of local government unit (LGU) constituents and members of the community. The researcher used a Likert-scale type questionnaire and analyzed it through statistical data treatment such as mean and weighted mean. Based on the findings, The Municipality of Bongabon are capable for manpower and training and development. But with regards to the perception of the respondents the local chief executives are not transparent to any program and any plan of their barangay.*

Moreover, it can be concluded that there is existing human resource program for the community that will help for the everyday used of the people. As well as for the revenue generations of the less fortunate who have no permanent work, and lastly, the study concluded that the local chief executive should open to the public all the plan and any program so that all people are well-informed.

Keywords**— *Local Government Unit, Manpower training, Human Resource Program, Training and Development, Manpower development.***

I. INTRODUCTION

Development of human resources plays a tremendous role in prompting valuable programs for people's needs in the community.Tolulope (2016) stated that training in manpower increases workers ' better understanding, making them strong and knowledgeable about what they are doing, increasing job satisfaction and rising employee turnover.

Thus, Obisi (2011) discovered that organizations, by not planning and equipping their trainees before, during and after a training program, show poor attitude towards training administration. Further, Adele and Ibietan (2017) concluded that the process of political governance and policy (especially the phase of budgeting) was not fair to education and training in the workforce.

Olaniyan and Ojo (2008) concluded that training decreases the work of the manager in terms of close supervision and also increases the motivation, effort and quality of the work of the staff, thus enabling them to be more committed to achieving the organization's goals and objectives and this has a potential to increase the productivity of the organization's workforce.

Bature and Mustapha (2013) recommended that the management will promote staff training at all levels and also vote a reasonable amount for the training and development of manpower.

Encapsulated in the title is the researcher's desire to clarify the definitive role of a public administrator. Furthermore, the researcher hopes to determine if there is a relevant interplay between the latter's management cum leadership style and skillful manipulation of the budget.

II. CONCEPTUAL FRAMEWORK

According to Okotoni and Erero (2005), training and development helps ensure that members of the organization have the knowledge and skills they need to successfully perform their jobs, take on new roles and adapt to changing circumstances.

Nwaeke and Obiekwe (2017) concluded that an organization that does not train and develop its workforce, or that puts little emphasis on it, is promoting employees' obsolescence and inflexibility.

Further, Ologunowa et al. (2015) concluded that the appropriate and efficient preparation of the bulk of any

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organization's labor force is greatly needed to enable it to accomplish a defined goal with optimum efficiency and effectiveness.

III. OBJECTIVES OF THE STUDY

The study described the local chief executive officer's management style, the effectiveness of human resource programs, and the support of LGUs in the municipality of Bongabon to the manpower training and development programs.

IV. METHODOLOGY

The study used descriptive method as it describes the present condition and further concerns with the condition or relationship that exists; practices that prevail; and beliefs and processes that are going on; effects that being felt or trends that are developing (Cohen, Manion, Morrison, 2002). A total of 50 respondents composed of local government unit (LGU) constituents and members of the community. The researcher used a Likert-scale type questionnaire (Vagias, 2006) and analyzed it through statistical data treatment such as mean and weighted mean.

V. RESULTS AND DISCUSSIONS

Table 1. Local Chief Executive Officer's Management Style

The local chief executive officer…	WM	VI
1. has an effective management style.	3.88	Strongly Agree
2. plans before executing any action or program.	3.80	Strongly Agree
3. is organized with his programs.	3.66	Strongly Agree
4. directs his people well.	3.48	Strongly Agree
5. assigns and delegates specific tasks and functions to his/her people.	3.54	Strongly Agree
6. coordinates well with other people and sector to accomplish programs and project	3.19	Agree
7. consistently performs managerial tasks such as planning, organizing, directing, staffing and coordinating.	3.54	Strongly Agree
8. is rated outstanding in his/her performance.	3.78	Strongly Agree
9. has made policies for management of manpower training development and other programs related to the former local chief executive officer.	3.54	Strongly Agree
10. has implemented changes to manpower training and development programs or other programs for improvement.	3.35	Strongly Agree
Average Weighted Mean	3.58	Strongly Agree

Table 1 presents the management style of the local chief executive officer. Based from the results, it can be derived that the local chief executive officer has an effective management style as respondents strongly agreed to this with the weighted mean of 3.88. While it was noted that the local chief executive officer coordinates well with other people and sector to accomplish programs and project as respondents agreed to this with the weighted mean of 3.19.

Table 2. Effectiveness of Human Resource programs

Statement	WM	VI
1. There is an existing human resource program effective for revenue generation.	3.54	Strongly Agree
2. The human resource programs address people's need.	3.55	Strongly Agree
3. The existing human resource program are efficient in terms of resources.	3.44	Strongly Agree
4. One of the human resource programs addresses education and scholarship needs.	3.32	Agree
5. One of the human resource program addresses environmental problems and concerns.	3.16	Agree
6. One of the human resource program addresses industry promotion needs.	3.16	Agree
7. The manpower training and development programs are open to all citizens within its jurisdiction.	3.32	Strongly Agree

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8. The manpower training and development programs improve community's livelihood.	3.26	Strongly Agree
9. The manpower training and development programs serve as a bridge for unemployed and underemployed citizens to employment.	3.02	Agree
10. The manpower training and development programs have effective trainers and speakers.	3.12	Agree
Average Weighted Mean	3.29	Strongly Agree

Table 2 presents the effectiveness of the human resource programs. Based from the results, it can be derived that the human resource programs address people's need as respondents strongly agreed to this with the weighted mean of 3.55. While it was noted that the manpower training and development programs serve as a bridge for unemployed and underemployed citizens to employment as respondents agreed to this with the weighted mean of 3.02.

Table 3. Support of the LGUs to its manpower training and development programs

	Statement	WM	VI
1.	There is a budget allocated for human resource programs.	3.38	Strongly Agree
2.	Support from the provincial and national levels are felt through programs and projects in the community.	3.50	Strongly Agree
3.	The local chief executive officer provides a system of information for manpower training and development disseminated to the community.	1.55	Strongly Disagree
4.	The local chief executive officer is transparent with the budget proposal for the manpower training and development programs.	1.56	Strongly Disagree
5.	In meetings for budget allocation, there is a participation involving members of the community.	2.02	Disagree
6.	The training objectives for the members of community as participants are clearly defined.	3.22	Strongly Agree
7.	Trainings are available for both individual and group categories.	2.94	Agree
8.	There is a review or period of review for the schedule of trainings.	3.01	Agree
9.	The local chief executive officer underwent training for the promotion of good governance and management.	3.22	Strongly Agree
10.	There is a budget allocated for the training of the local chief executives and other officials.	3.10	Agree
	Average Weighted Mean	3.58	Strongly Agree

Table 3 presents the support of the LGUs to its manpower training and development programs. Based from the results, it can be derived support from the provincial and national levels are felt through programs and projects in the community as respondents strongly agreed to this with the weighted mean of 3.50. Thus, it was noted that the local chief executive officer provides a system of information for manpower training and development disseminated to the community as respondents strongly disagreed to this with the weighted mean of 1.55.

VI. CONCLUSIONS

The Municipality of Bongabon are capable for manpower and training and development. But with regards to the perception of the respondents the local chief executives are not transparent to any program and any plan of their barangay.

Moreover, it can be concluded that there is existing human resource program for the community that will help for the everyday used of the people. As well as for the revenue generations of the less fortunate who have no permanent work.

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And lastly, the study concluded that the local chief executive should open to the public all the plan and any program so that all people are well-informed.

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Perception of Micro Enterprises Employers towards demonstrated Employability Skills and Attitudes of On-The-Job-Training Business Students

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Abstract**—** *To ensure their graduates are prepared and employable, the significance of developing skills suitability and attitude among students should be considered vital. This paper determined the expected employability skills and attitudes of on-the-job-training/intern students. The descriptive method of research was used in this study. The researcher distributed survey questionnaires to a total of 50 micro enterprise employers were surveyed around Nueva Ecija which are composed of mostly restaurant-type businesses. Based from the data gathered and calculated results of expected skills, it can be implied that the on-the-job-training/intern students totally demonstrated the skills categorized as lifelong learning and understanding professional, social and ethical responsibilities. On the contrary, the on-the-job-training/intern students totally undemonstrated the skills categorized as business system approach. Summing up, the on-the-job-training/intern students demonstrated the expected employability skills. Further, the data gathered and calculated results of expected attitudes implied that the on-the-job-training/intern students totally demonstrated the attitudes categorized as motivated and cooperation. Meanwhile, the on-the-job-training/intern students totally undemonstrated the attitude categorized as commercial awareness/awareness of the industry. Summing up, the on-the-job-training/intern students demonstrated the expected employability attitudes.*

Keywords**— *On-the-job-training, Expected Skills and Attitude, Business Students, Intern Students, Employability.***

I. INTRODUCTION

To ensure their graduates are prepared and employable, the significance of developing skills suitability and attitude among students should be considered vital. Chiu et al. (2016) stated that a deliberate strategy of professional training programs would prepare students for quality young jobs, which could bring economic benefits to the nation.

Wye and Lim (2009) concluded that graduates must have the right work values and find their first job after graduation as a means to gain useful experience, used as a forum to secure future jobs. Singh and Singh (2008) further stated that employability skills are common in nature rather than job-specific, and are spread across all sectors, companies, from the entry-level worker to the most senior position

Selvadurai et al. (2012) concluded that measures to improve transferable skills are not exclusively the responsibility of the tertiary education system, but the company must play a greater role in delivering on - the-job instruction.

In view of the foregoing insights, the researcher would like to assess the employability perception of micro enterprises employers towards the demonstrated skills and attitudes of on-the-job-training business students.

II. CONCEPTUAL FRAMEWORK

Lowden (2011) concluded that employers expect students from their degrees to have the academic and disciplinary skills, but allow graduates to show a variety of wider skills and attributes that include coordination, collaboration, leadership, critical thinking, problem solving, and often managerial or future abilities.

Likewise, Zaharim et al. (2009) concluded that graduates must develop the skills and attitudes required to be ready to work globally upon graduation.

Buenviaje et al. (2015) recommended that the college head be able to continually compare with other business schools

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for program enhancement and linkages on international business graduates access may also be discussed.

III. OBJECTIVE OF THE STUDY

This study determined and described the expected employability skills and attitudes of on-the-job-training/intern students.

IV. METHODOLOGY

The descriptive method of research was used in this study because it involves description, recording, analysis and interpretation of condition that really exists. It is appropriate to use descriptive method in gathering information about the present existing condition (Creswell, 2014). A total of 50 micro enterprise employers were surveyed around Nueva Ecija which are composed of mostly restaurant-type businesses.

The researcher distributed survey questionnaires which adapted Likert-scale type responses (Vagias, 2006) and analyzed it through statistical data treatment such as mean and weighted mean.

V. RESULTS AND DISCUSSIONS

Table 1. Expected Employability Skills of On-the-job-training students

Skills	Statement	WM	VI
The on-the-job-training/intern student has…			
Communication effectively	the ability to present ideas with confident and effective through aural, oral and written modes, not only with business but also with the community at large	3.12	Demonstrated
Competent in application and practice	the ability to use the techniques, skills, and modern business tools	2.25	Undemonstrated
Interpersonal or team working skills	the ability to function effectively as an individual and in a group with the capacity to be a leader or manager as well as an effective team member	2.96	Demonstrated
Business problem-solving and decision making skills	the ability to undertake problem identification, apply problem solving , formulation and solutions.	1.99	Undemonstrated
Apply knowledge of business principles	the ability to acquire and apply knowledge of business fundamentals.	2.83	Demonstrated
Competent in specific business discipline	the ability to acquire in-depth technical competence in a specific business discipline.	2.91	Demonstrated
Understand professional , social and ethical responsibilities	the ability to understand the social , cultural, global and environmental responsibilities of a professional businessman, and commitment to professional and ethical responsibilities.	3.23	Totally Demonstrated
Lifelong learning	the ability to recognize the need to undertake life-long learning, and possessing / acquiring the capacity to do so.	3.31	Totally Demonstrated
Business system approach	the ability to utilize a systems approach to design and evaluate operational performance	1.65	Totally undemonstrated
Knowledge of contemporary issues	the ability to continue learning independently in the acquisition of new knowledge, skills and technologies.	3.52	Totally Demonstrated
	Average Weighted Mean	2.78	Demonstrated

Adapted from: Hassan et al. (2012) Department if Institutions of Higher Education Management, Ministry of Higher Education, Malaysia.

Table 1 presents the Expected Employability Skills of On-the-job-training students. Based from the results, it can be derived that the OJT/intern students has ability to continue learning independently in the acquisition of new knowledge, skills and technologies as employers rated it as totally demonstrated with the weighted mean of 3.52. While it was noted that the OJT/intern

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students has the lack of ability to utilize a systems approach to design and evaluate operational performance as employers rated it as totally undemonstrated with the weighted mean of 1.65.

Table 2. Expected Employability Attitudes of the On-the-job-training students

Attitude	Statement	WM	VI
The on-the-job-training/intern student is…			
Enthusiastic	able to work using their own initiative	2.55	Undemonstrated
Individuality	capable of independent work	2.73	Demonstrated
Accountability	demonstrating that they can take responsibility	3.06	Demonstrated
Cooperation	able to work as part of a team	3.36	Totally Demonstrated
Leadership	able to lead when appropriate	2.64	Demonstrated
Motivated	able to network: being able to form relationships and get to know people	3.44	Totally Demonstrated
Commercial awareness/awareness of the industry	having a wider knowledge of business and wider implications of how knowledge and is shaping the market and knowing where the company sits in a particular industry	1.71	Totally Undemonstrated
Ambition	willing to learn and taking responsibility for their own development	2.58	Undemonstrated
Curiosity	reflective about themselves and what they want out of the job	3.02	Demonstrated
Self-confidence	confident that they are applying for work that matches their aspirations	3.16	Demonstrated
	Average Weighted Mean	2.83	Demonstrated

Source: Higher Education Careers Services Unit (2010)

Table 2 presents the Expected Employability Attitudes of the On-the-job-training students. Based from the results, it can be derived that the OJT/intern student is able to network: being able to form relationships and get to know people as employers rated it as totally demonstrated with the weighted mean of 3.44. While, it was noted that the OJT/intern student lacks wider knowledge of business and wider implications of how knowledge and is shaping the market and knowing where the company sits in a particular industry as employers rated it as totally undemonstrated with the weighted mean of 1.71.

VI. CONCLUSIONS

Based from the data gathered and calculated results of expected skills, it can be implied that the on-the-job-training/intern students totally demonstrated the skills categorized as lifelong learning and understanding professional, social and ethical responsibilities. On the contrary, the on-the-job-training/intern students totally undemonstrated the skills categorized as business system approach. Summing up, the on-the-job-training/intern students demonstrated the expected employability skills.

Further, the data gathered and calculated results of expected attitudes implied that the on-the-job-training/intern students totally demonstrated the attitudes categorized as motivated and cooperation. Meanwhile, the on-the-job-training/intern students totally undemonstrated the attitude categorized as commercial awareness/awareness of the industry. Summing up, the on-the-job-training/intern students demonstrated the expected employability attitudes.

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Study the Line Length Impact on the Effective of Overvoltage Protection in the Low Voltage Network

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Abstract**—***The overvoltage protection devices on low-voltage power lines (SPD) are often made using GDA and MOV technology. The selection, proper use and installation of overvoltage protective devices, taking into account the effect of line length and the types of combinations that will affect the protection efficiency, is essential. This paper builds GDA and MOV models with high similarities to the prototype. The evaluation of protection efficiency with different types of coordination and the effect of line length was investigated by simulation-modeling method in simulink environment of Matlab software.*

Keywords**— *GDA (Gas Discharge Arrester), MOV (Metal Oxide Varistor), SPD (Surge Protective Device), Protection Efficiency, Simulink, Matlab.***

I. INTRODUCTION

Previous studies have focused on surge protection on low-voltage power lines for equipment with the assumption that lightning impulses directly affect the protective equipment [1, 2]. However, in practice it is necessary to combine protective devices manufactured under MOV technology [3], and the line with characteristics containing capacitance and inductance acting as a surge reduction filter.

Therefore, it is necessary to study the impact of line length on the protection efficiency of the overvoltage protection in the low voltage distribution network under the condition of combining the installation of SPD using MOV technology and GDA technology. The results of the research were tested by the simulation modeling method in Simulink/Matlab environment.

II. GDA MODEL

2.1. Electric Arc Equation between two Electrodes

The GDA model that takes into account the arc appearing between the two electrodes is built as a mathematical model, describing the electrical properties of the arc. This type of model does not simulate complex physical processes within a circuit breaker, but describes the behavioral voltage of GDA. Measurement of voltage and current signals is used to extract differential parameters for differential equations that describe the non-linear resistance of the electric arc for specific measurements.

According to Mayr, the differential equation describing the arc phenomenon between the electrodes of GDA is presented by the expression (1) [4, 5, 6, 7].

$$\left.\begin{array}{l}\dfrac{dx(1)}{dt}=\dfrac{u(2)}{\tau}\left(\dfrac{e^{x(1)}u(1)^2}{P}-1\right)\\ y=e^{x(1)}u(1)\end{array}\right|\left.\begin{array}{l}\dfrac{d\ln g}{dt}=\dfrac{u(2)}{\tau}\left(\dfrac{gu^2}{P}-1\right)\\ i=gu\end{array}\right. \quad (1)$$

Where: x (1) is the state variable of the differential equation, and is the natural logarithm of the arc conductivity ln(g); x (0) is the initial value of the state variable, which is, the initial value of the arc conductivity: g(0); u (1) is the first input variable of the DEE block, this is the arc voltage u; u (2) is the second input variable of the DEE block, representing the circuit breaking of circuit breaker: u (2) = 0 when the contacts of the circuit breaker are closed and u (2) = 1 when the contacts of the circuit breaker are open.; y is the output variable of the DEE block, this is the arc current i; g is the conductance of the arc; u is the arc voltage; i is the arc current; τ is the arc constant of time; P is the cooling energy.

2.2. GDA model

The breakdown voltage is the parameter of the control switch SC (Switch Control). When the voltage applied to the GDA (on the switch K) reaches the value of the breakdown voltage, a time delay is calculated according to

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the empirical interpolation formula, corresponding to the gas discharge tube. This value is about 10 -100μs depending on slope of overvoltage (dV/dt).

When the voltage between the two poles of the GDA reaches the value of the breakdown voltage, GDA won't discharge immediately but after a delay, which depends on the slope of the overvoltage.

The burning arc state is simulated under the arc model proposed by Mayr.

The above GDA model is a bipolar device with symmetrical bidirectional characteristics. There is a note that the switch of GDA will not be able to switch to the "off" state when the amperage falls below the value of the current sustained (usually 100mA) or the voltage drops below the generating arc voltage. arc. The equivalent GDA diagram is shown in *Fig.1*.

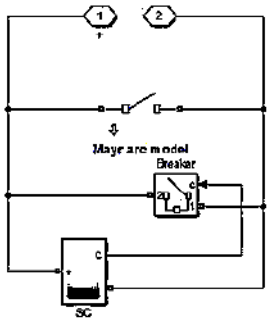

Fig.1 GDA equivalent circuit

2.3. Blocks' Functions

2.3.1. Switch Control (SC) block

The V1 (Voltage measurement) meter measures the voltage between the two electrodes of the gap, and this continuous voltage signal is converted to a discrete signal by the Transfer Fcn unit whose sampling period is 0.001μs. The output voltage signal of the Transfer Fcn block is taken to the absolute value through the Abs block and goes to the comparator block (Compare to Constant) to compare with the breakdown voltage value of the gap, Vb. When the voltage across the gap of the two poles exceeds the value of the breakdown voltage, the output of the Compare to Constant unit will be high and close the Breaker lock. The Breaker lockout signal is passed through a block of time delay (Unit delay) with a time delay of td (Figure 2).

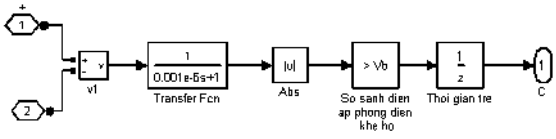

Fig.2 Block diagram of SC lock-off control

2.3.2. Gaps block

The gap block diagram in Figure 3 is considered equivalent to the Breaker block, two resistor elements R1, Rarc of the model are declared in the Breaker block. The leakage resistance R1 of the gap is 100MΩ declared in the Snubber resistance Rs parameter, the Rarc arc resistance is 2MΩ declared in the Breaker resistance Ron parameter. The Breaker block uses an external control mode (External control mode), the initial state of the lock is the open state (Initial state parameter is zero). Block Breaker Interface (Figure 3).

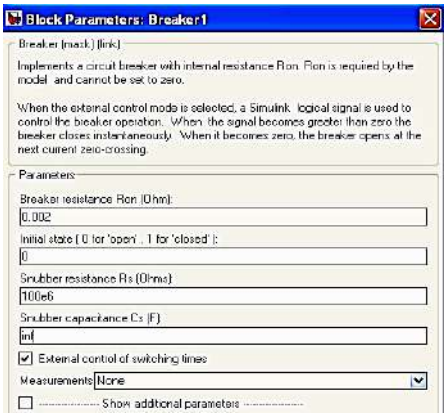

Fig.3 Parameter input interface of the Breaker block

2.3.3. Arc model block

The arc model block is built according to Mayr's proposal (Figure 4).

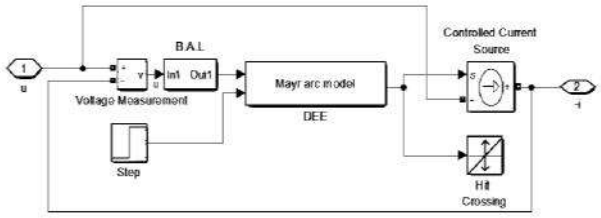

Fig.4 The arc model block was built according to Mayr's proposal

The function of the blocks in the model is as follows: DEE (Differential Equation Editor): the differential equation set-up; Hit Crossing block detects when there is an input signal, in this case it is the current, across the value of 0; Step block is used to control the circuit breaking of the circuit breaker; B.A.L: Gain and integral volume; Voltage Measurement: GDA voltage measuring device between two poles; Controlled Current Source: Source current dependent.

Link the element blocks of the GDA model and establish the interface of the overvoltage protection element model according to GDA technology (Figure 5).

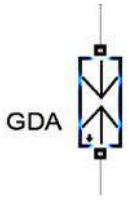

Fig.5 The GDA model interface.

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2.3.4. Check the accuracy of the GDA model

To check the accuracy of the proposed GDA model, we simulate a protection voltage value corresponding to the standard impulse 25kA 10/350µs and compare it with the protection voltage value provided by the manufacturer [8]. Circuit diagram of simulation is shown in *Fig.6*.

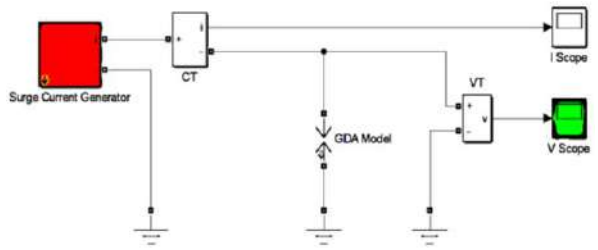

Fig.6 GDA simulation circuit diagram.

By comparing the values of protection voltage through simulation (Vpsim) with the values of protection voltage provided by the manufacturer (Vpcat) which is presented in Table 1. We determine the error protection voltage (ΔV%), this is also an error of the GDA model.

Table 1: Value of protection voltage corresponding to 25kA 10/350µs surge current

Code	I(kA)	V_{pcat}	V_{psim}	ΔV%
DEHNventil M TNC 255	25	1500	1492	0,5
DEHNventil M TNC 255FM	25	1500	1485	1,0

Comment: the proposed GDA model has a high accuracy, the largest error value is 1% and is within the allowed range <5%.

III. MOV MODEL

3.1. MOV's mathematical equation

The mathematical equation describing the relationship V = f (I) of MOV is presented in the expression (2).

$$V = (1+TOL/100).[B_1 * I^{B2} + B_3] \quad (I > 0) \qquad (2)$$

Where: TOL is the threshold voltage tolerance of MOV provided by the manufacturer; the coefficients B_1, B_2 and B_3 are determined by using the MOV V-I curve and the cftool tool of Matlab software.

Table 2: The Bi coefficient values of common MOVs of Siemens Company

Code	V_n(V)	I_s(kA)	V=f(t)
B32K275	275	25	B_1=14,93; B_2=0,4011; B_3=579,2
B40K275	275	40	B_1=14,71; B_2=0,3962; B_3=578,8
B60K275	275	70	B_1=16.67; B_2=0,3507; B_3=573,4
B80K275	275	100	B_1=8,282; B_2=0,4053; B_3=564,5
B32K320	320	25	B_1=22,34; B_2=0,3847; B_3=664,7
B40K320	320	40	B_1=18,02; B_2=0,3935; B_3=674,5
B60K320	320	70	B_1=12,49; B_2=0,4163; B_3=680,5
B80K320	320	100	B_1=6,729; B_2=0,4575; B_3=667,7

3.2. The equivalent circuit to MOV model

The MOV model is shown in *Fig.7*.

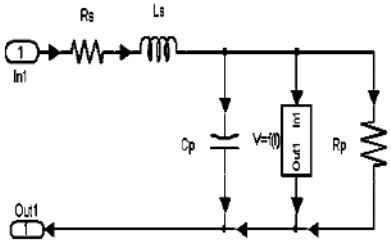

Fig.7 MOV model [9]

With R_S = 100nΩ, R_P = 100MΩ, LS and CP have different values for different types of MOV, provided by the manufacturer.

The V-I block diagram of MOV is shown in *Fig.8*.

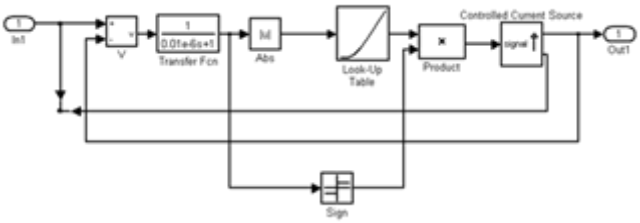

Fig.8 The V-I block diagram of MOV

The V-I relational unit of the MOV element is treated as a controlled current source unit with the current I is a nonlinear function controlled by voltage V. The non-linear resistor element uses the voltage measurement block to measure the voltage at the poles of the non-linear element, then passes through the Transfer Fcn block to convert the signal to the discrete from continuous voltage signal with a sampling period of 0.01µs. The output signal is sent to Abs Block to get absolute value and then fed to Look-Up Table block. The Look-Up Table block has the function of looking up the table, for each input voltage value will produce the current value corresponding to the expression (2). The output signal is multiplied by the output of the Signal block (the marker block of the voltage on the 2 poles of the MOV element) and forms the accented current signal. However, this output signal is only Simulink signal, this signal needs to be sent through the controlled current source block to convert into a current signal.

3.3. Check MOV model accuracy

The accuracy of low-voltage MOV element model is determined by comparing the protective voltage value of the MOV element through simulation and the protection

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voltage value provided by the manufacturer. Circuit diagram of simulation is shown in *Fig.9.*

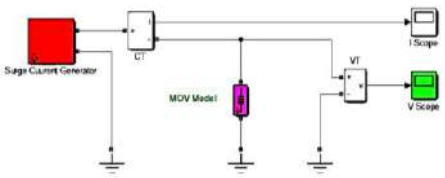

Fig.9 MOV simulation circuit

The result of comparing the value of protection voltage through simulation (Vpsim) and the value of protection voltage provided by the manufacturer (Vpcat) [10] is presented in Table 3. From these data, we determine voltage protection error (ΔV%), this is also the error of MOV model.

Table 3: Value of protection voltage corresponding to 10kA 8/20μs surge current of common MOVs (Siemens)

Code	I(kA)	V_{pcat}	V_{psim}	ΔV%
B32K275	10	1200	1182	1.5
B40K275	10	1166	1147	1.6
B60K275	10	1000	1001	0.1
B80K275	10	917	919	0.2
B32K320	10	1433	1438	0.3
B40K320	10	1366	1352	0.1
B60K320	10	1267	1262	0.4
B80K320	10	1132	1128	0.4

Comment: Proposed MOV model has high accuracy, the largest error of protection voltage value is 1.6% and is within the allowed range <5%.

IV. LINE LENGTH AND COMBINATION IMPACT ON PROTECTION EFFICIENCY

4.1. Structure of overvoltage protection model

The IEC 62305-4 standard covers over-voltage protection systems and introduces the concept of lightning protection zones (LPZ) to protect against the electromagnetic effects of lightning strikes. It is assumed that a power supply line passing through two protection areas should be protected by an overvoltage protective device. Fig.10 shows the installation location and the different protection levels of overvoltage protection in the low voltage network.

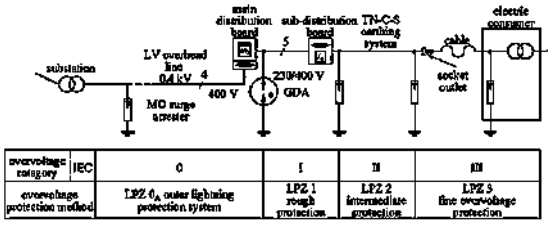

Fig.10 SPD installation location in low voltage network

Surge protective devices corresponding to LPZ0 levels should be able to withstand surge current up to 50kA 10/350μs. LPZ1 (GDA) class overvoltage protective devices should be able to withstand surge current up to 25kA 10/350μs. Surge protective devices (MOVs) corresponding to LPZII should be able to withstand surge currents up to 25kA 8/20μs. The overvoltage protection device (MOV) of LPZIII level should be able to withstand surge currents up to 5kA 8/20μs.

Below, uses the spreading parameter line model to analyze the effect of low voltage line length on GDA operation.

The line parameters per 1km:

- Resistor R_L=0,471Ω/km.
- Inductance L_L=1521μH/km.
- Capacitance C_L= 10,39nF/km.

The test model is a building located in the inner city area. GDA technology overvoltage protection device is located in the main distribution board at the entrance to the building (Cat C). The low-voltage conductor has a cross-section of 70mm^2, r_0=0.471Ω/km, L_0=1521μH/km, C_0=10.39nF/km. Load consumption has the following parameters: U_n=230V, cosφ=0.8, I_L=350A. Calculate P=112kW, Q = 84kVar. The following, examines the protection efficiency of GDA according to the installation distance to the consumption load.

4.2. Overvoltage protection model with GDA

Circuit diagram of GDA protection efficiency according to installation distance is shown in Fig.11.

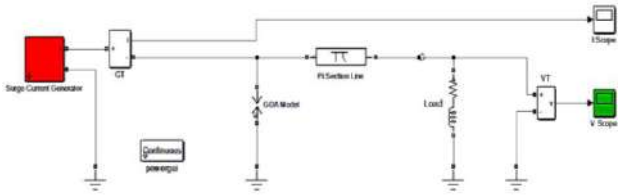

Fig.11 GDA protection simulation circuit

Protection voltage corresponding to surge current 20kA 8/20μs with installation distance of GDA L=1m is shown in *Fig.12.*

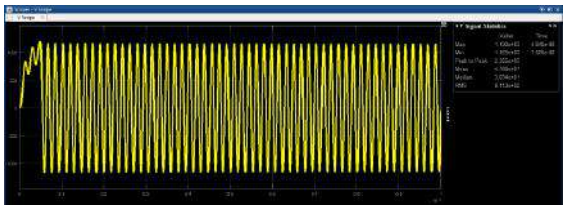

Fig.12 Protection voltage corresponding to surge current 20kA 8/20μs with installation distance of GDA L = 1m

Table 4: The protection voltage of SPD according to technology GDA with installation distance varying from 1m-5m, corresponding to surge current 20kA 8/20μs

L(m)	Protection Voltage V_P 20kA 8/20μs
0	1019
1	1190
2	1235
3	1462

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4	1610
5	1680

Comment:

- The higher the protection voltage value is corresponding to the longer installation distance.
- The protection voltage value is relatively high even in the case of L = 1m. Therefore, GDA can only protect the electrical equipment.

4.3. Overvoltage protection model with MOV

Circuit diagram of simulating protective efficiency of *MOV according to installation distance is shown in Fig.13.*

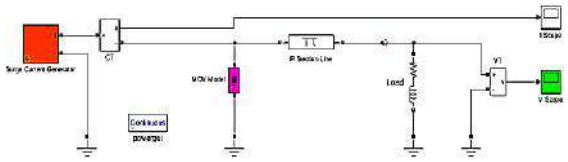

Fig.13 Simulating circuit of MOV protection effect according to installation distance

Protection voltage corresponding to surge current 20kA 8/20µ with installation distance MOV L= 1m is shown in Fig.14.

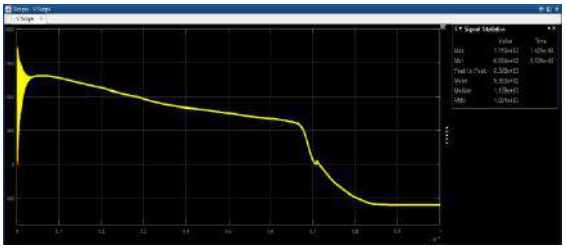

Fig.14 Protection voltage corresponding to surge current 20kA 8 / 20µs for MOV installation distance L = 1m

Table 5: The protection voltage values of the SPD according to MOV technology with installation distance varying from 1m to 5m, corresponding to 20kA 8/20µs.

L(m)	Protection Voltage V_p 20kA 8/20µs
0	1315
1	1719
2	1607
3	1812
4	1928
5	1996

Comment:

- The higher the protection voltage value according to longer installation distance.
- The protection voltage value is relatively high even in the case of L=1m. Therefore, MOV can only protect the electrical equipment.

4.4. Overvoltage protection model with GDA + MOV

The combined circuit diagram of SPD type GDA and SPD type MOV is shown in *Fig.15*. Here, the SPD type GDA is installed in the main distribution board and the GDA type MOV is installed in the sub distribution board at 5m, 10m, 15m and 20m distance from the main distribution board.

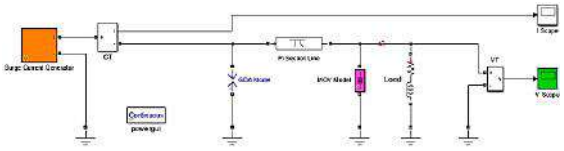

Fig.15 The combined circuit diagram of SPD type GDA and SPD type MOV

The protection voltage corresponding to surge current 20kA 8/20µs is shown in *Fig.16.*

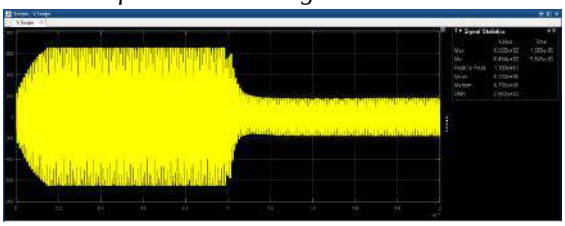

Fig.16 Protection voltage corresponding to surge current 20kA 8/20µs

Table 6: The protection voltage values of SPD according to GDA and MOV technology with the installation distance varying from 5m to 20m, corresponding to surge current 20kA 8/20µs

L(m)	Protection Voltage V_p 20kA 8/20µs
5	735
10	649
15	649
20	649

Comment:

- In the case of combined protection of GDA and MOV, the voltage across the load is much lower than the case of protection with GDA or MOV.
- Protection voltage value varies from 650V to 735V. Therefore, the combined SPD type GDA and SPD type MOV allows to protect the electronic device.

V. CONCLUSION

The paper has proposed:

- Building the SPD type MOV model based on finding V-I relationship by non-linear regression algorithm with the help of cftool tool in Matlab.
- Building the SPD type GDA model, considering the electric arc between the electrodes to improve the accuracy of Spark Gap model.
- Research the protection efficiency of lightning overvoltage protection on low voltage power lines taking into account the line length impact in case of using SPD type GDA, SPD type MOV and the case of combining these two types of SPD.

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Determining the MOV Element Number of Surge Protective Device, Manufactured by Multi-Block MOV Technology

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Abstract**—***SPDs manufactured using multi-block MOV technology can indicate the remaining life (in %) of the SPD, thus helping users to plan appropriate replacement and maintenance. However, because the threshold voltage error of parallel-coupled MOV elements is not the same, the rated impulse current of the SPD manufactured by multi-block MOV technology is not equal to the total of the rated impulse current of parallel-coupled MOV elements. The paper presents the method of determining the number of parallel MOV elements of multi-block MOV according to the allowed dissipation energy method with the help of Matlab software and modelling and simulation technique.*

Keywords**—** ***Surge Protective Device (SPD), Multi-block MOV, Dissipation energy.***

I. INTRODUCTION

In order to prevent the spread of lightning on low-voltage distribution networks, Surge Protection Device (SPD) are currently popular used, manufactured according to MOV technology, with two types of MOV Single-block and MOV Multi-block [1, 2]. SPDs manufactured with Single-block MOV technology have large rated impulse current (SPD grade 2, from 40kA to 100kA 8/20µs), but these SPDs are not able to display the remaining life of SPD. This makes it difficult for users to maintain and replace the SPD to ensure the protection level according to the original design.

SPDs are manufactured using multi-block MOV technology, including low lightning dissipation MOV components (8kA 8/20µs and 25kA 8/20µs) in parallel-coupled to form SPDs with high lightning current dissipation capability like SPD manufactured by Single-block MOV technology. SPDs manufactured using multi-block MOV technology can indicate the remaining life (in%) of SPDs, thus helping users to plan appropriate replacement and maintenance. However, because the threshold voltage error of parallel-coupled MOV elements is not the same, the rated impulse current of the SPD manufactured by multi-block MOV technology is not equal to the total of the rated impulse current of parallel-coupled MOV elements [3]. This paper delves into the study and proposes a method for determining the number of MOV elements in parallel-coupled, in order to achieve high amplitude lightning impulse dissipation capability (type I - SPDs I) on the basis of allowed dissipation energy.

II. MOV MODEL

The V-I characteristic of MOV in *Fig.1* is represented by the exponential equation [6]:

$$I = KV^{\alpha} \alpha > 1 \quad (1)$$

Where: I is the current through MOV, V terminal voltage at MOV, K is a factor dependent on MOV type, α is the nonlinear factor.

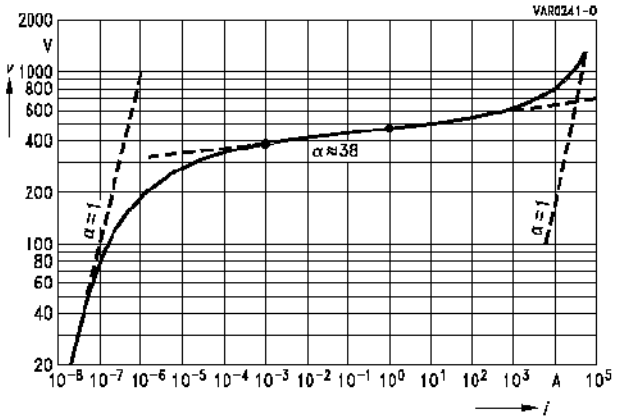

Fig.1 The V-I characteristic of MOV

Manfred Holzer and Willi Zapsky approximate MOV's V-I characteristic by the equation:

$$\log V = B1 + B2 \log(I) + B3 \cdot e^{-\log(I)} + B4 e \log(I) \text{ with } I > 0 \quad (2)$$

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Or:

$$V = 10^{B_1 + B_2 \log(I) + B_3 e^{-\log(I)} + B_4 e^{\log(I)}} \quad (3)$$

Where: The values for B1, B2, B3 and B4 depend on each MOV type.

MOV model can be replaced by equivalent circuit diagram as *Fig.2* [4].

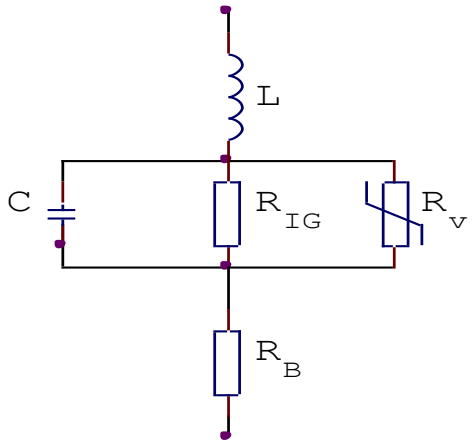

Fig.2 The equivalent circuit model of MOV

Where: L is the wire inductance (≅ 1nH/mm), C is the capacitance of the metal oxide rheostat, R_{IG} is the junction resistance between zinc oxide particles (ρ = 10^{12}→ 10^{13}Ωcm), R_V is the ideal rheostat, the nonlinear resistor (0 →∞Ω), R_B is the resistor of zinc oxide (ρ=1÷10 Ωcm).

The absorbed energy of MOV is determined by the equation (4):

$$W = \int_{t0}^{t1} v(t)i(t)dt \quad (4)$$

Where: v (t) is the voltage across MOV during the time that current i (t) passes.

In order to MOV not to be damaged, the absorbed energy of MOV must not exceed the allowed energy specified by the manufacturer.

III. DISTRIBUTE CURRENT IN MOVS PARALLEL-COUPLED

When analysing the heterogeneity of the threshold voltage parameters to the current through the MOV in parallel-coupled of the SPD device consists of n low voltage MOVs: M1, M2, ...Mi, ...Mn in parallel-coupled (*Fig.3*). Assume that MOV V1 has a threshold voltage error of -10%, and (n-1) the MOV has the same threshold voltage error of + 10%. When an impulse current i with a waveform of 8/20μs passes through them then:

$$i = i_1 + i_2 + ... + i_i + \ldots + i_n$$

$$v_1 = v_2 = \ldots = v_i = \ldots = v_n$$

$$v_1 = f(i_1)$$

$$v_i = f(i_i)$$

$$v_n = f(i_n)$$

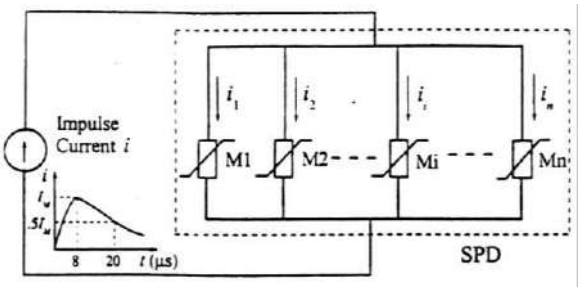

Fig.3 Current distribution of elements in parallel-coupled MOV

Where: i_1, i_2, i_i and in are current flowing through MOV (M_1, M_2, M_i and M_n) and V_1, V_2, V_i and V_n are voltage of MOV (M_1, M_2, M_i and M_n), corresponding $V_i = f(i_i)$ is the current- voltage characteristic MOV M_i, with the current-voltage relation formula: $i_i = CV_i^{\alpha}$ with C is a constant and α is a nonlinear factor.

Found that: when MOV elements are in parallel-coupled, the rated impulse current of the SPD will not be equal to the sum of the rated impulse current of the MOV elements:

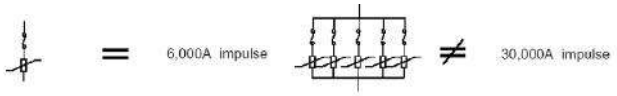

Fig.4 The rated impulse current of the SPD in the case of MOV elements is not homogeneous.

In this case, the ISPD rated impulse current of the surge protective device is not equal to the total impulse current of MOV elements in parallel-coupled:

$$I_{SPD} \neq n\, I_{MOV} \quad (5)$$

To keep the parallel MOVs operate safety, the safe reserve of the rated impulse current of the SPD should be considered in the SPD design.

$$I_{SPD} = nk_r I_{MOV} \quad (6)$$

Where: $k_r \geq 1$ is the safety reserve factor of the rated impulse current of the SPD.

IV. DETERMINING THE NUMBER OF N MOVS IN MULTI-BLOCK MOVS ACCORDING TO DISSIPATION ENERGY METHOD

For multi-block MOV, there are n MOV elements with the following parameters [5]:

- Rated impulse current I_1 (kA), waveform 8/20μs.
- The allowed dissipation energy W (J).

The number of MOV elements of a multi-block MOV with a rated impulse current I_t(kA) of 8/20μs waveform can be determined by the following steps:

Building simulation circuit includes:

- Pulse generator I_t (kA) 8/20μs waveform.
- Building multi-block MOV model including n MOV elements with rated pulse current I_1(kA), 8/20μs waveform. In particular, MOV_1 has a threshold voltage error of -10% and parallel-

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coupled with (n-1) MOV has a threshold voltage error of + 10%.

- Perform the energy dissipation simulation through MOV_1 and observe this energy value according to the number of n changes.
- The simulation process stops when the energy dissipated through MOV_1 reaches the permitted value. Then, identify n MOV elements need to be parallel-coupled.

V. DETERMINE THE ELEMENTS NUMBER OF THE COMMON MULTI-BLOCK MOV

Requires multi-block MOV design capable of dissipating lightning impulses I_t=40kA 8/20µs from the MOV components of Siemens has the code B32K275 with W=360J with a threshold voltage error of ΔV% = ± 10%. The simulation circuit is shown in Figure 5 with the number of MOV elements n = 5.

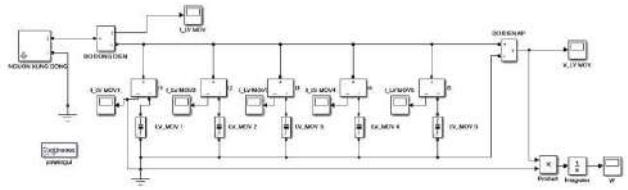

Fig.5 The MOV multi-block simulation circuit consists of 5 MOV elements B32K275

For MOV_1 there is a threshold voltage error of -10% (MOV must suffer the largest current of all MOV elements) and the remaining MOV_s have a threshold voltage error of + 10%. The current pulse shape through MOV_1 is shown in Fig.6, the horizontal voltage pulse shape through MOV_1 is shown in Fig.7, and the dissipation energy shape of MOV_1 is shown in Fig.8.

From *Fig.8*, determine the largest energy dissipation of MOV_1 is W_{max}=343J<W_{cp} = 360J. Choose n = 5, that means the ability to dissipate lightning impulse rated of MOV in multi-block MOV is 5x25 = 125kA 8/20µs.

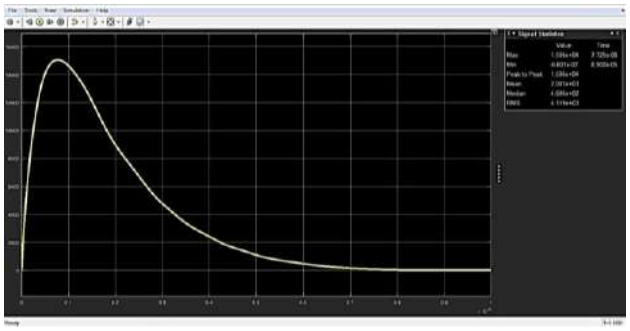

Fig.6 The current pulse shape through MOV_1

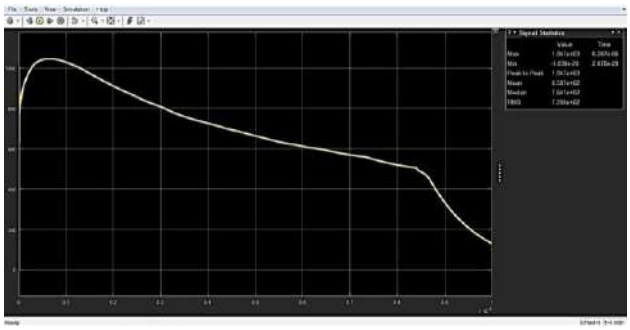

Fig.7 The horizontal voltage pulse shape through MOV_1

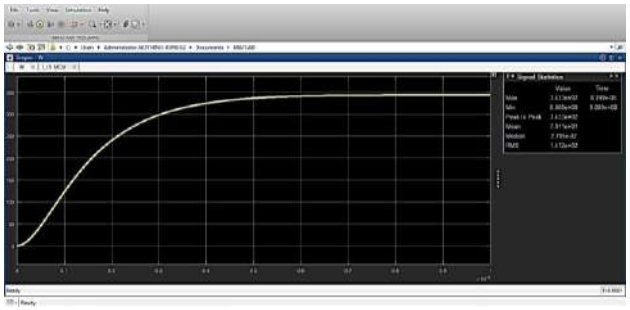

Fig.8 The dissipation energy shape of MOV_1

Similarly, using the power dissipation method, determine the number of MOV elements of multi-block MOVs with rated pulse currents of 25kA, 40kA, 50kA, 70kA and 100kA 8/20µs. The results listed in Table 1 with the K_r reserve factor are determined by the ratio of the total of the rated pulse current of MOV elements to the rated pulse current of multi-block MOV.

Table 1: The number of MOV elements of the common multi-block MOV

Multi-block MOV	**The number of MOV elements**		**The reserve factor K_r (%)** (1)/(2)
	B32K275 (1), 25kA 8/20µs ΔV%=±10%	S20K275 (2), 8kA 8/20µs ΔV%=±10%	
25kA 8/20µs	-	9	-/2,9
40kA 8/20µs	5	16	3,1/3,2
50kA 8/20µs	7	21	3,5/3,3
70kA 8/20µs	10	37	3,6/4,2
100kA 8/20µs	15	45	3,7/3,6

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VI. CONCLUSION

This paper presents the method of determining the number of MOV elements in parallel-couple of multi-block MOV according to the energy dissipation method allowed with the support of Matlab software and modelling and simulation techniques.

The number of MOV elements of a common multi-block MOV with 25kA, 40kA, 50kA, 70kA, and 100kA 8/20µs rated pulse currents are listed as a lookup table that allows multi-block MOV manufacturers to reference during the design process and Producing multi-block MOV in reality.

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