

CHAPTER V

DATA ANALYSIS AND INTERPRETATION

5.0 Introduction

The previous chapter dealt with the development and implementation of PBL based internship curriculum for third year undergraduate civil engineering students. The present chapter presents the data collected for the present study with the researcher designed and experts validated tools of data collection. The analysis and interpretation of data was analyzed by using suitable technique for qualitative and quantitative analysis.

5.0.1 Objectives of present study or conducted PBL based internship program

- To assess the need and scope for implementing Project Based Learning for internship program at bachelor's level of Civil Engineering.
- To develop the Project Based Learning curriculum for internship program at bachelor's level of Civil Engineering.
- To implement the Project Based Learning curriculum for internship program at bachelor's level of Civil Engineering program.
- To study the effectiveness of the developed Project Based Learning curriculum for internship program at bachelor's level of Civil Engineering program.
- To study the improvement in technical competence/gained field knowledge for the conducted Project Based learning curriculum at the bachelor's level of Civil engineering program.
- To study the development and improvement in soft skills for the conducted Project based learning curriculum at the bachelor's level of Civil engineering program.

Table 5.1 *The following table describes the objectives of the study, type and nature of data, data collection and analyze the implementation of present study*

Objectives of Study	Type of Data	Nature and Source of data	Tools of data collection	Data Analysis	Implementation
To assess the need and scope of Implementation of PBL based internship curriculum	Quantitative Qualitative	AICTE's employability study (per Table 1.3, 1.4 of Chapter 1 and as referenced)	Employability numbers for fresh graduates.	Qualitative Quantitative	Field experience prepares fresh graduates.
To develop the PBL based internship curriculum	Quantitative Qualitative	Classroom knowledge and Project Based Learning	Field Group project practicums.	Qualitative Quantitative	Impart Field Knowledge and Develop soft skills.
To implement the PBL based Internship Curriculum	Quantitative Qualitative	Background Theory and Developed PBL based internship project practicums as discussed in Chapter 2	PBL based PILOT Internship program	Qualitative Quantitative	PBL based Internship Project practicums
To study the effectiveness of the developed PBL curriculum for internship	Quantitative Qualitative	Developed Achievement tests and rubrics	Pre, Post, Delayed Post test Group Reports and Presentation	Quantitative Qualitative	Improvement in gained Field knowledge and developed and improved soft skills.
To study the improvement in technical competence	Quantitative	Developed Achievement tests	Pre-test Post-test Delayed Post-test	Quantitative	Field Knowledge gained during Group Project practicums
To study the improvement in soft skills	Qualitative	Developed Rubric	Daily, Weekly project Reports and Presentation	Qualitative	Rubric based descriptive analysis

5.1 Tools and nature of data collection

To study the effectiveness of implemented PBL based internship program's curriculum, the data was collected by different tools of data collection.

Table 5.2

Below table presents the nature and tools of data collection for present study or PBL based internship program.

Tools and Nature of data collection	
Tools	Nature of data collection
Pre-test	Conducted before implementation of PBL based internship program's curriculum
Daily and weekly reports	Submitted reports on daily and weekly basis during the implementation of PBL based internship program's curriculum for conducted field practicum.
Post-test	Conducted after the implementation of PBL based internship program's curriculum for conducted field practicum.
PBL based internship Project report	Students submitted after implementation of PBL based internship program's curriculum for conducted field practicum
PBL based internship Project Presentation.	Students submitted after implementation of PBL based internship program's curriculum for conducted field practicum
Supervisor Evaluation/ Feedback	Feedback from field supervisors after implementation of PBL based internship program's curriculum for conducted field practicum.
Student Evaluation/Feedback	Feedback from students after the implementation of PBL based Internship program's curriculum for the conducted field practicum.
Delayed Post-test	Conducted after the gap of three months from the implemented PBL based Internship program's curriculum.
Post or delayed site questionnaire	Conducted after the gap of three months from the implemented PBL based Internship program's curriculum.

5.2 Data Analysis

Data analysis for the present study's objectives and are formulated for this study as to determine the effectiveness of the developed PBL based curriculum for internship program.

5.2.1 Quantitative analysis - To measure the improvement in technical competence of the students. Following tools were administered for quantitative analysis.

By comparing the mean achievement scores of researcher's administered pre-test and post-test.

By comparing the mean achievement scores of researcher's administered pre-test, post-test and delayed post-test.

5.2.2 Qualitative analysis - To study the development and improvement in the soft skills in the students. Following tools were administered for qualitative analysis.

By assessing, evaluating, and analyzing the student's performance for technical report writing and presentation skills.

By assessing, evaluating, and analyzing the feedback provided by PBL based internship project practicum supervisors for supervisor feedback/evaluation form.

By assessing, evaluating, and analyzing the feedback provided by students for student feedback/evaluation form for conducted PBL based internship project practicums.

Researcher's observations on students' interactions, involvement, and improvement in technical field knowledge while conducting PBL based internship project practicums.

By measuring the students' reflectiveness and retention for the gained field knowledge by administered the delayed post-test after the gap of three months of conducted project practicums for PBL based internship program.

5.2.1.1 Analysis of Pre-test and Post-test

Table 5.3

Scores obtained by sample students for conducted pre-test and post-test of PBL based Internship program.

Summary statistics for Pre-test and Post-test data							
No.	Trial	Mean Scores	Standard deviation	Coefficient of correlation	Standard error of mean	Standard error of difference	Normal Distribution 't' values
33	Pre-test	42.64	10.04	0.68	3.06	1.35	11.18
33	Post-test	57.76	9.47		2.72		

No. - Number of students

df - degree of freedom.

Table 5.3 depicts scores obtained by sample of thirty-three students for pre-test and post-test conducted before and after completion of present study or PBL based internship program. The normal distribution statistical method was used to calculate the t values. The calculated t values are later compared with critical t-table values obtained from normal distribution curve. (Appendix 20 - detailed statistics sheet)

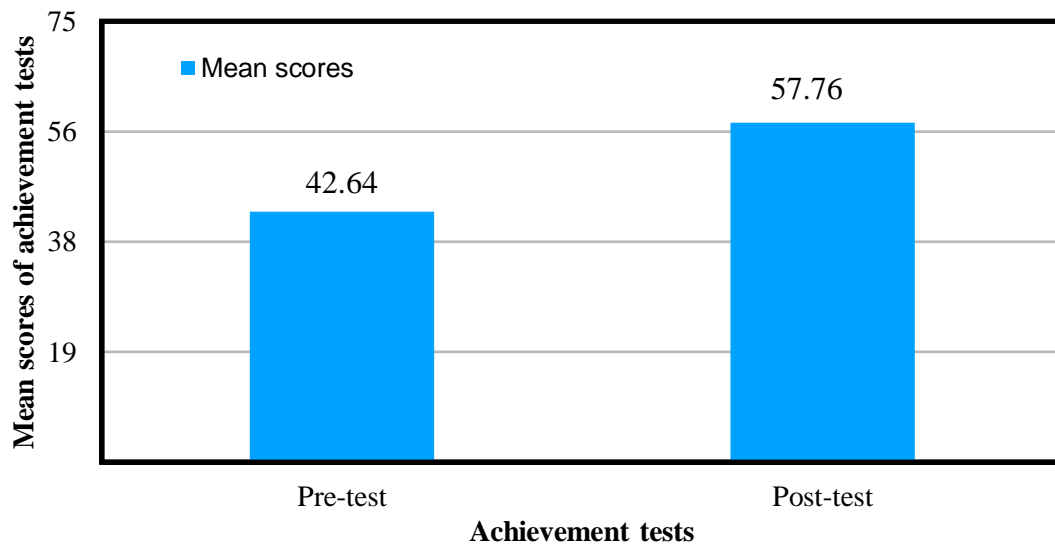


Figure 5.1a Bar Graph showing the students mean achievement scores of Pre-tests and Post-test

Figure 5.1a showed our computed value of t - 11.18 is greater than the t - table (Appendix 19 - t values table) critical values 2.04, 2.7 at 0.01 and 0.05 level respectively. Consequently, looking at the mean scores achieved for pre-test (42.64)

and post-test (57.76), it can be said that the incorporated PBL Internship program had contributed to significant improvement in the gained field knowledge or technical competence of the students, hence the assumed null hypothesis is rejected.

5.2.1.2 Analysis of Pre-test, Post-test, and Delayed Post-test

Table 5.4

Scores obtained by the sample students for pre-test, post-test, and delayed post-test for PBL based internship program.

Mean achievement scores for Pre-test, Post-test, and Delayed post-test		
N (No of students)	Administrative tests	Mean scores
33	Pre-test	42.64
33	Post-test	57.76
33	Delayed post-test	50.27

Table 5.4 shows the mean achievement scores of the pre-test, post-test, delayed post-test. The mean achievement score value of pre-test is 42.64, post-test 57.76, delayed post-test 50.27. The calculated t values are shown in Appendix 20- detailed statistics sheet

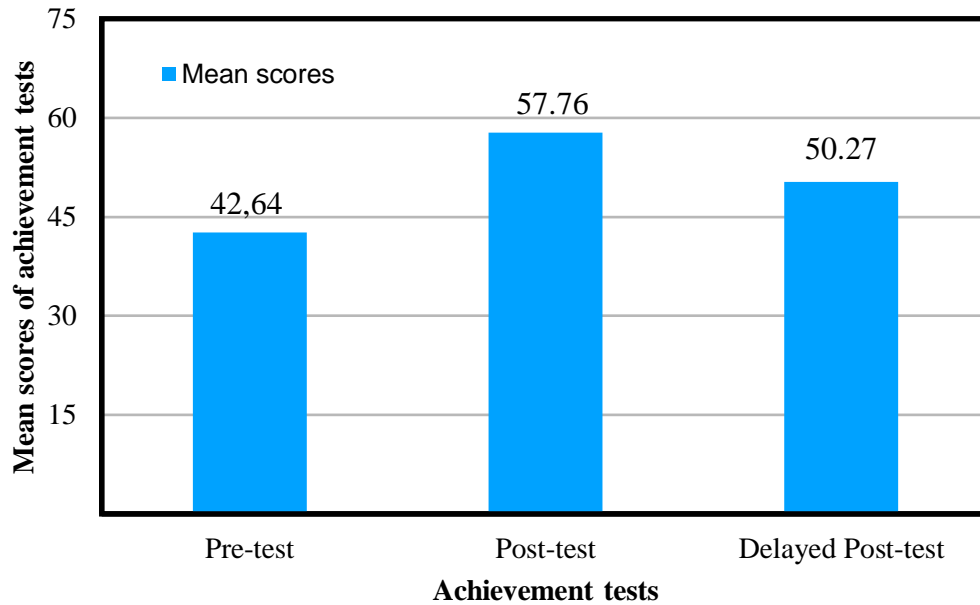


Figure 5.1b Bar Graph showing the students mean achievement scores of Pre-test Post-test and Delayed Post-test.

Figure 5.1b above in the form of bar graph shows the mean achievement scores of the pre-test, post-test, delayed post-test.

The mean achievement score value of pre-test is 42.64, post-test 57.76, delayed post-test 50.27. Comparing pre-test, post-test scores and increase in mean value number showed the improvement in gained field knowledge of the program participants in post-test mean scores as compared to pre-test mean scores. The mean score value of the delayed post-test comparing with pre-test and post-test revealed that students had retained the gained field knowledge attained during attending the PBL internship program even after the time span of three months of implemented Internship program. Hence the PBL based internship program participants retained the significant improvement level in technical competence.

5.2.2.1 Statistics for qualitative analysis of technical writing for project reports and project presentations of students for PBL based internship program.

Table 5.5

Development in technical writing skills for project practicums.

Rubric for project technical report writing for project practicums.				
Parameters	Poor	Fair	Very good	Excellent
Content and Organization	0%	20%	43%	37%
Guided Format	0%	33%	30%	37%
Language	43%	6%	50%	0%
Average %	14%	20%	41%	25%

Projects reports which were submitted by students on daily, weekly, and final report were graded by the researcher. Researcher had observed the significant improvement in technical writing of students with regards to field placement practicum. Table 5.5 shows the students' performance in development of technical writing skills in project report writing for project practicums for the project reports submitted by students. The students' performance for projects reports were measured based on provided rubric or parameters such as content and organization, format, language of the submitted project reports after attending PBL based internship program.

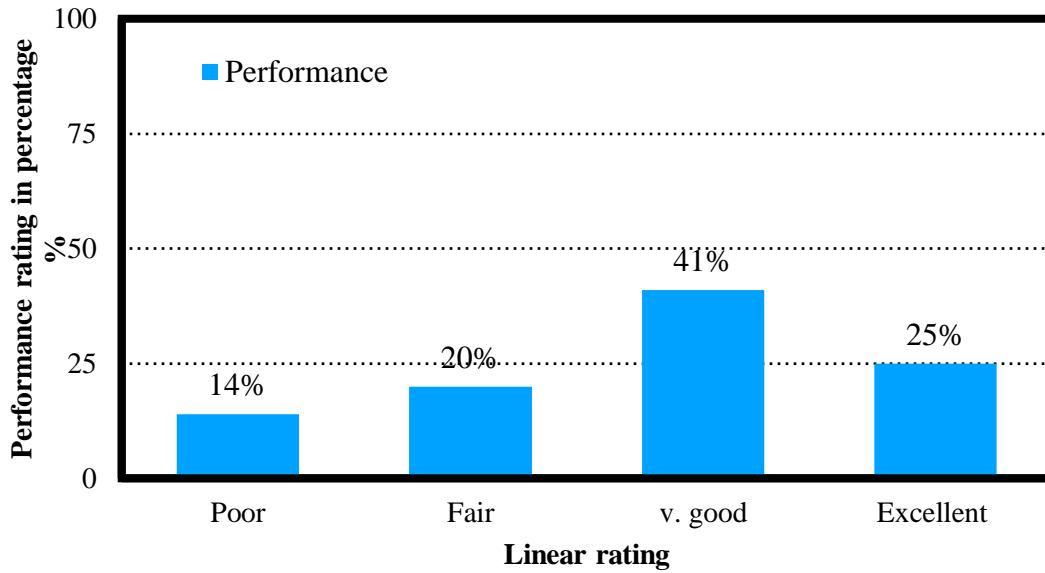


Fig 5.2 Bar graph showing students' performance in development of technical writing skills for project practicums.

Figure 5.2 shows that 14% students performed poor, 20% as good, 41 % as very good and 25% performed excellent for the PBL based internship project report writing. The daily reports and weekly reports were evaluated on daily and weekly basis for students' growth in gaining knowledge, report description, technical writing, interaction, and inquiries with the site supervisors for the assigned field practicums for PBL based internship program.

Table 5.6

Students' performance for the delivered project presentations for conducted project practicums

Rubric for oral presentation of project presentations for PBL based internship practicum				
Parameters	Below Expectation	Needs improvement	Satisfactory	Exceeds Expectation
Organization, Content and Delivery	10%	23%	47%	20%

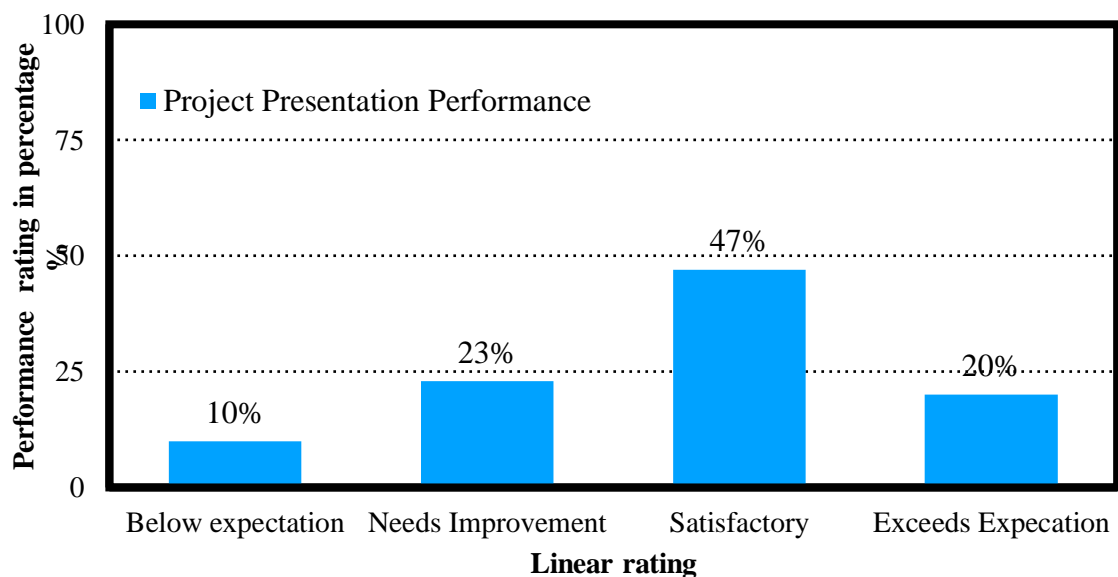


Fig 5.3 Bar Graph showing the development of soft skills in group project presentation

Figure 5.3 represents the performance analysis of students' presentation skills for PBL based internship program, 20% of the students had done extremely well by properly sequencing the topics and presenting it in a flow. 47% performed satisfactorily, 23% of students had organized the content well but needed some improvement in delivering the content and while having interactions with the audience. 10% of team members appeared uncomfortable and anxious during group project presentations.

5.2.2.2 Analysis for Supervisor's evaluation and feedback.

Supervisor's feedback was taken on four parameters to measure development and improvement in soft skills and technical competence skills. The feedback was collected on site supervisor's feedback form for four parameters, communication skills, problem solving skills, teamwork skills and technical competence. An open-ended feedback form was also administered and collected from the site supervisor.

- I. Communication skills (Oral)
- II. Problem solving skills
- III. Teamwork skills
- IV. Technical Competency Skills
- V. Open ended feedback questions

Table 5.7

Analysis of site supervisors feedback form for developed and improved soft and technical competency skills/ 1(poor), 2 (fair), 3 (good), 4 very good), 5 (excellent)

Site Supervisor's linear rating for developed and improved skills in students after conducting project practicums							
Main parameters	Functional Parameters	1	2	3	4	5	Average rating out of 5
Communication skills	Clarity	0%	0%	25%	75%	0%	3.75
	Relevance	0%	0%	49%	51%	0%	3.51
	Organization	0%	0%	75%	25%	0%	3.25
Problem Solving skills	Define	0%	0%	49%	51%	0%	3.51
	Analyses	0%	0%	100%	0%	0%	3.0
	Evaluate	0%	0%	49%	51%	0%	3.51
Teamwork Skills	Rapport	0%	0%	0%	75%	25%	4.25
	Openness	0%	0%	0%	49%	51%	4.51
	Effort	0%	0%	25%	75%	0%	3.75
	Synthesis	0%	25%	25%	50%	0%	3.25
Technical Competency Skills	Understanding	0%	0%	25%	75%	0%	3.75
	Confidence	0%	0%	25%	75%	0%	3.75

Table 5.7 showed the measurement and analysis of different parameters for which the feedback of supervisor was collected on Likert scale. The detailed parameters were measured under the four main parameters such as communication skills, problem solving skills, teamwork skills, technical competency skills.

I. Communication skills Oral

1. Clarity - Can express clearly, comprehensibly, and easily understandable technical project practicum.

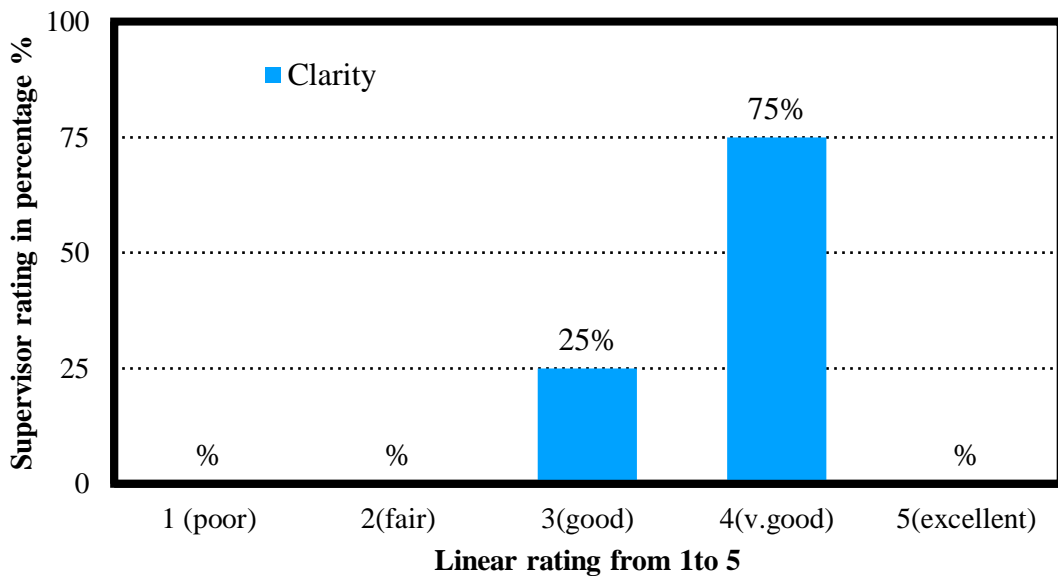


Figure 5.4 Bar Graph showing site supervisor's rating for clarity in understanding project practicum.

Figure 5.4 shows internship site supervisors feedback/rating for clarity in students understanding and discussing technical content of project practicums.

As per the internship site supervisors' feedback 75% of the students were very good (4), 25% (3) were good in clarifying their theoretical knowledge concepts while understanding the content of assigned project practicums.

2. Relevance - Can identify the relevant, to the point and related technical matter

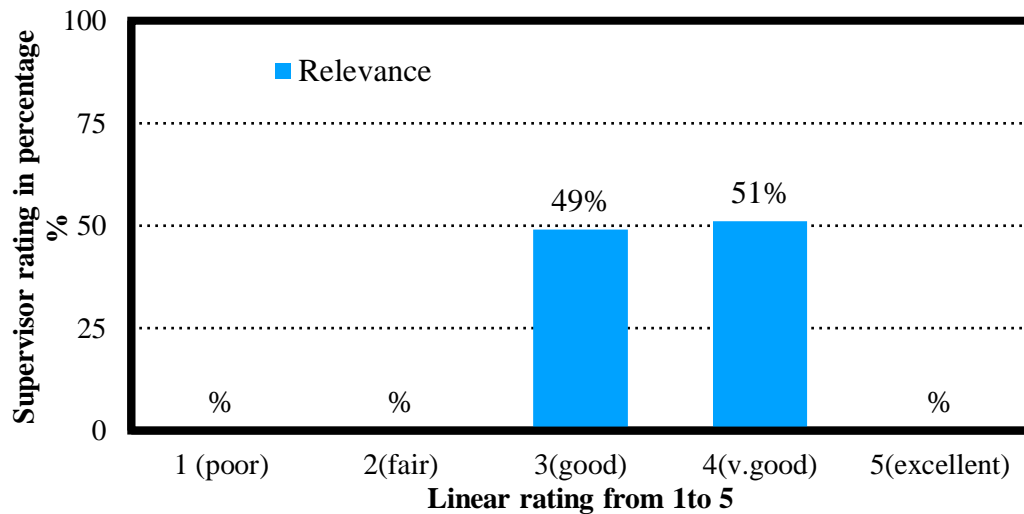


Fig 5.5 Bar Graph showing supervisor's rating for students on identifying relevance of technical content in project practicums.

Figure 5.5 shows site supervisors feedback in identifying relevance of learned theoretical course work/technical content to the conducted project practicums while communicating with site supervisors and team members.

Internship site supervisors responded/rated that 51% were very good (4), 49% were good (3) to identify and relate the technical content's relevance to project practicums. For example, students learned about foundation construction and concrete mixing in their course work, by conducting project practicums students were able to identify the construction activities and were able to relate it to the learned theoretical content for the same. Project practicums clarified their concepts and were also able to identify other unknown construction site challenges that may occur during foundation construction and concrete mixing.

2. Organization - Can logically organize, understand the general project practicum

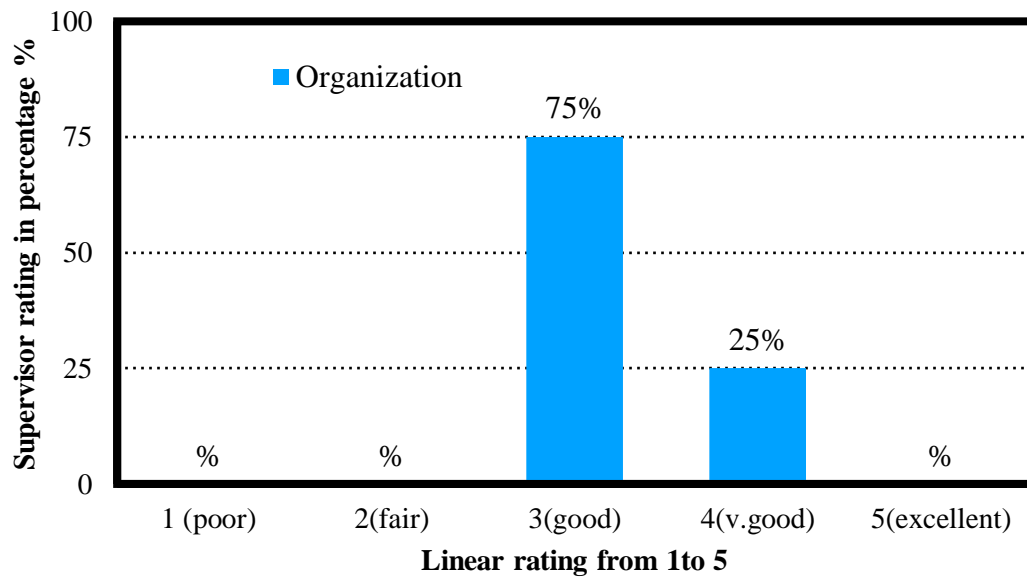


Fig 5.6 Bar Graph source of site supervisor rating for understanding and logically organizing the project practicums.

Figure 5.6 shows site supervisors feedback for understanding and logically organizing the project practicum technical content. As per the received responses, 25% of students were rated very good (4), 75% rated good (3). It showed that the site supervisors reported that most of the students can understand and logically organize while communicating in a group the project practicum technical content for daily and weekly reports for the conducted PBL based internship program.

- **Problem Solving skills**

1. Define - conceptualizes problems or questions in a workable and manageable manner while discussions with supervisor.

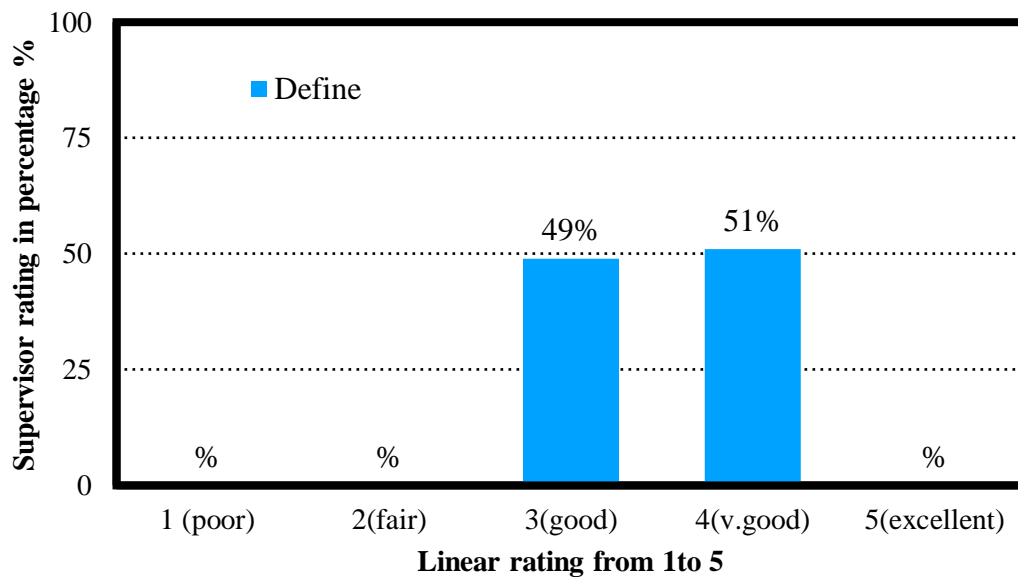


Fig 5.7 Bar Graph showing site supervisor's rating for defining the concept of problems in logical and workable way for project practicum.

Figure 5.7 shows construction site supervisors feedback for students in conceptualizes problems or questions in a logical way while in discussions with site supervisors. As per the feedback 51% of the students were rated very good (4), 49% rated good (3). It showed that as per supervisor's feedback showed that most of the students able to define, conceptualize the problems in a logical way. As mentioned by site supervisors that one of the questions asked by students is that during ready mix concrete plant practicums, the role of quality of material and weather conditions effect on the mixing ratios of materials. It depicts that student understood

the concept and asked logical questions which insights towards identifying possible challenges and seeking solutions to it.

2. Analyze - Breaks down into critical and significant components and try to develop proposed solutions.

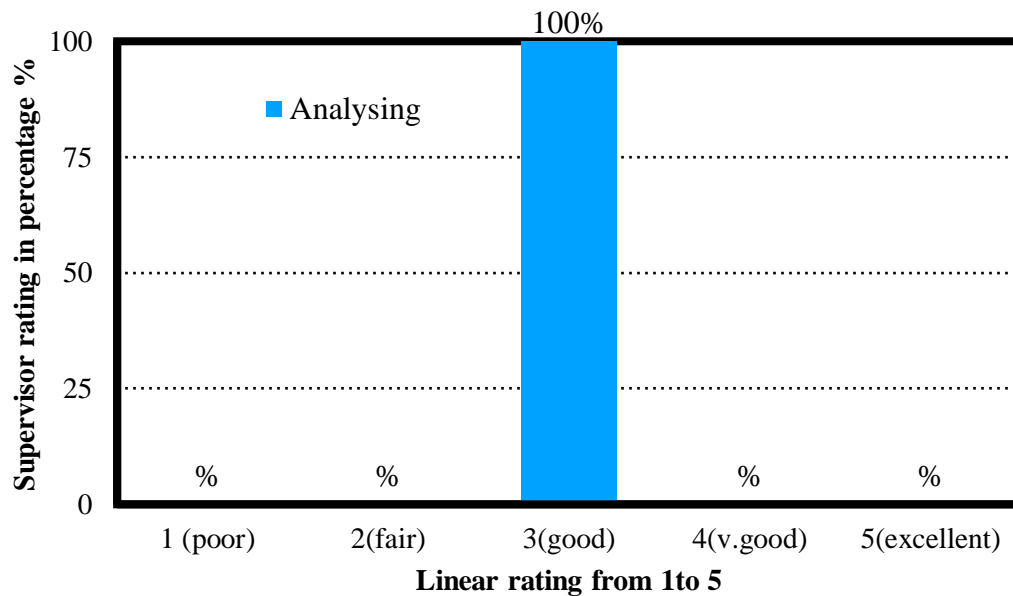


Fig 5.8 Bar Graph showing supervisor's rating for analyzing, developing and proposing solutions for the project practicum.

Figure 5.8 shows site supervisors feedback for identifying, analyzing and breaking down the components of construction site challenges/problems and seeking and proposing solutions which contributed in developing problem solving skills. As per the rated responses 100% of students rated good (3). It showed that supervisors reported that most of the students identified, analyzed the construction site challenges/problems, and interact with site supervisors and team members to develop solutions.

3. Evaluate - Understand and validates students' efforts in proposed solutions for proposing solutions for project practicum challenges and problems

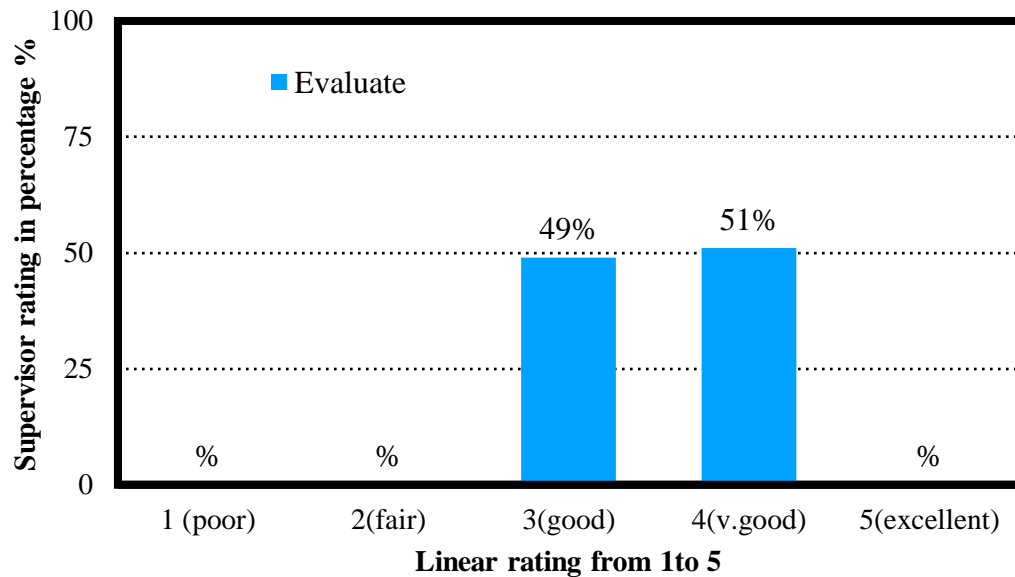


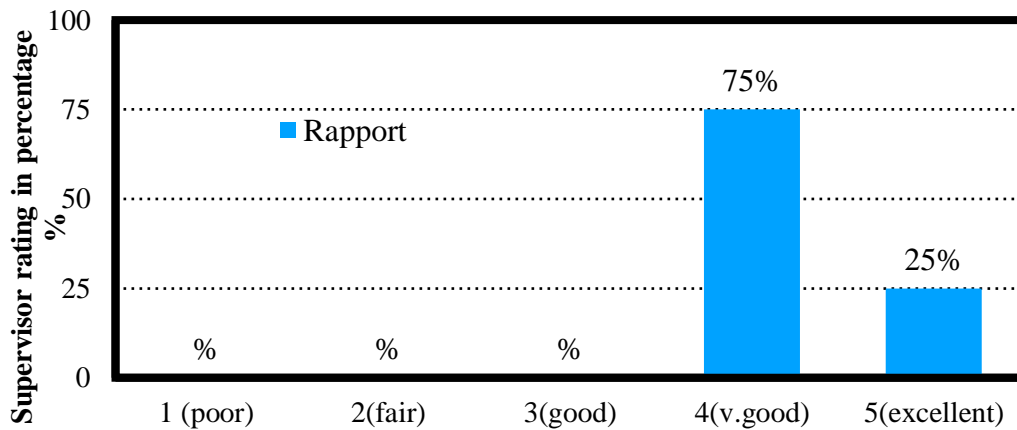
Fig 5.9 Bar Graph showing Site supervisors feedback for students' efforts in evaluating and proposing solutions for project practicum challenges and problems.

Figure 5.9 shows site supervisors response on students' efforts in evaluating and proposing the solutions for project practicum challenges and problems. As per the responses by supervisors 51% of the students were very good (4), 49% rated good (3). It showed that supervisor reported that most of the students involved in

evaluating, understanding, and putting an effort on proposing solutions during field practicum challenges.

III. Teamwork skills

1. Rapport - Demonstrates integrity in teamwork.



Linear rating from 1 to 5

Figure 5.10 Bar graph showing site supervisor's rating for students' demonstration of integrity in teamwork for the project practicums.

Figure 5.10 shows site supervisors response for students' demonstration for showing integrity working as a team member during teamwork. As per supervisor's rated responses 25% of students were excellent (5), 75% were very good (4). It showed that most of the students had maintained good rapport for demonstrating integrity, respecting team members opinion and work as a good team member while working in their respective teams.

2. Openness - Works productively as a team member in a group.

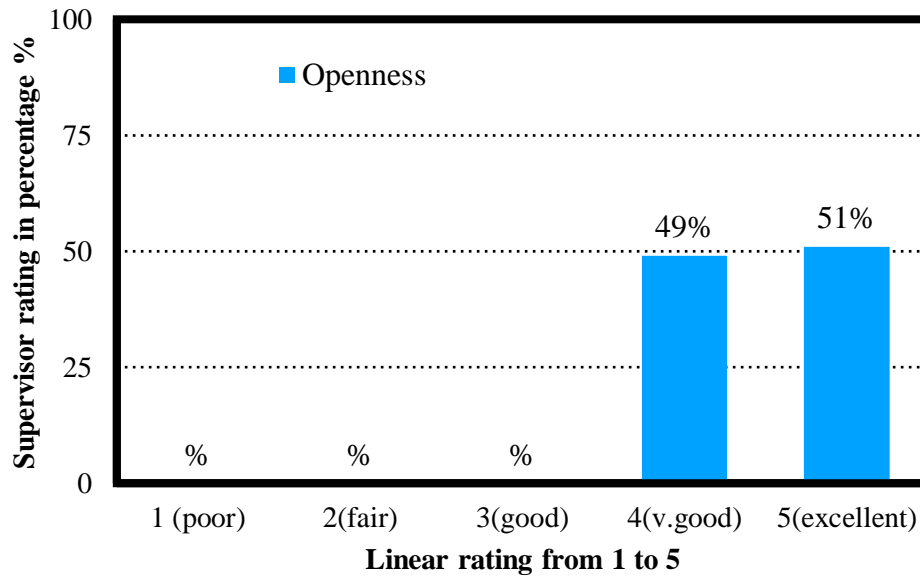


Figure 5.11 Bar graph showing site supervisor's rating for openness and working productively as team member for project practicums

Figure 5.11 shows how did respondents rated for openness and working productively as a team member. As per the rated responses 51% of students rated excellent (5), 49% rated very good (4). It showed that most of the students reported had worked as a productive team member by performing the given duties in a diligent manner.

3. Effort - Does fair share as team members in a group.

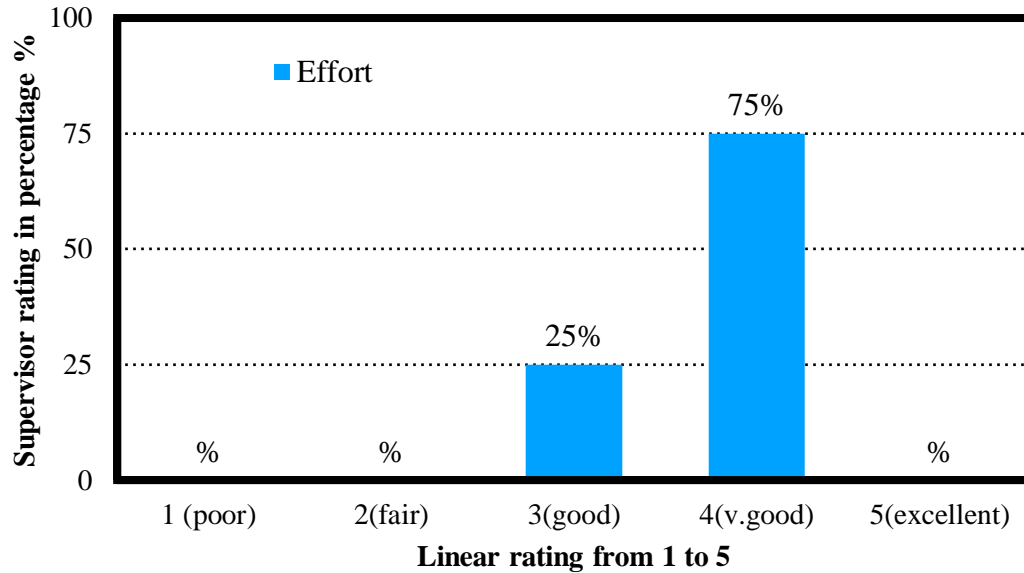


Fig 5.12 Bar Graph showing site supervisors rating for students' effort in doing fair share of contribution as a team member for project practicums.

Figure 5.12 shows site supervisors response for the student's effort as a team member in contributing and doing fair share of work while working with the assigned group for project practicums. As per the supervisors rated responses, 75% of students were rated very good (4), 25% rated good (3). It showed that the students put fair effort as a team member to distribute and share the work responsibilities while working in a team.

4. Synthesis - Pulls together ideas, focus and try to draw conclusions while having discussions in a group

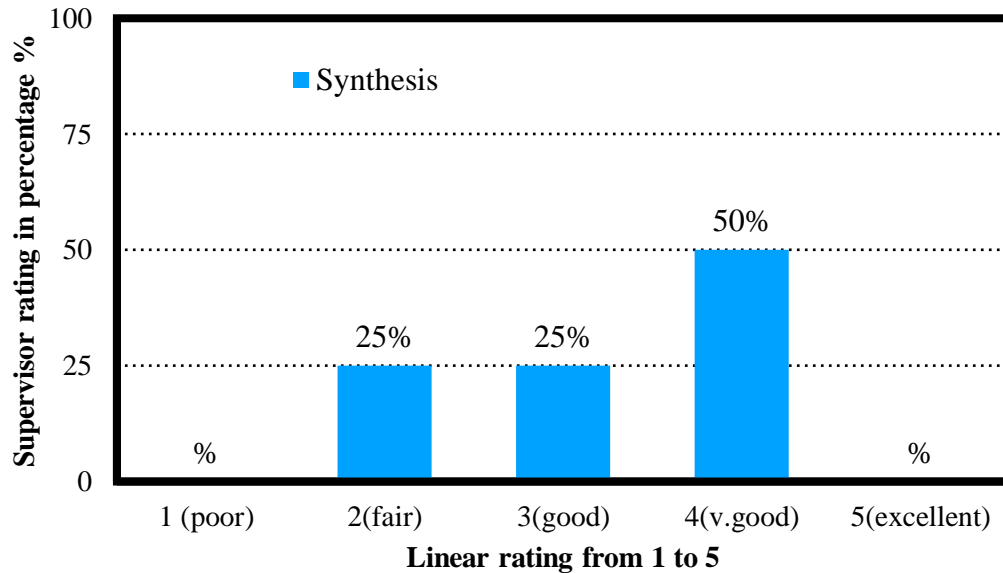


Fig 5.13 Bar Graph showing site supervisor's rating for students' ability in focusing and pulling together ideas as a team member for project practicums.

Figure 5.13 shows students responses for synthesis and drawing conclusions as a team while working with the assigned group. As per the rated responses, 57% of students rated very good (4), 25% rated good (3) and 25 % students rated as fair (2). It showed that most of the students had the ability to think, focus on ideas and contributed while drawing conclusions.

IV. Technical Competency Skills

1. Understanding - Have current level of understanding specific to internship program.

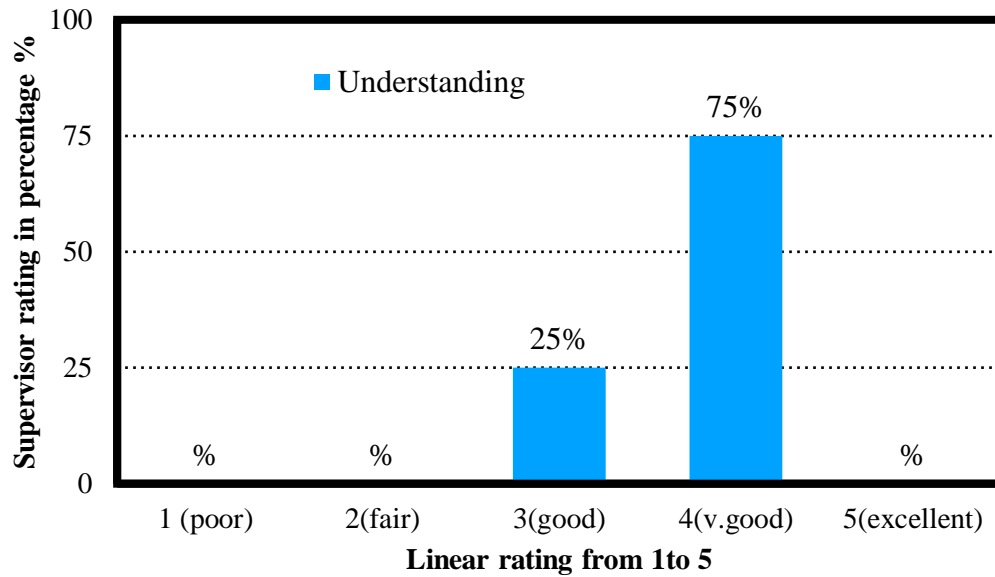


Fig 5.14 Bar Graph showing site supervisor's rating for students understanding the technical content and site scenarios for project practicums

Figure 5.14 shows site supervisors rating for students understanding in the technical content and site scenarios for project practicums. As per the rated responses 75% of students were rated very good (4), 25% were rated good. It showed that most of the students could understand the technical content of field practicums and reflect with the learned theoretical course work which results in gaining field knowledge or improvement in technical competence of students. Students learned about building construction and foundation design drawings in the classroom course work and by attending internship program project practicums students got an opportunity to learn and monitor the building and foundation construction details on the site. The conducted project practicums not only enhance students' knowledge but also clarify

the concepts about the subject that contributes in increasing their technical competence or field knowledge.

2. Confidence - Have current level of confidence in acquired knowledge and skills

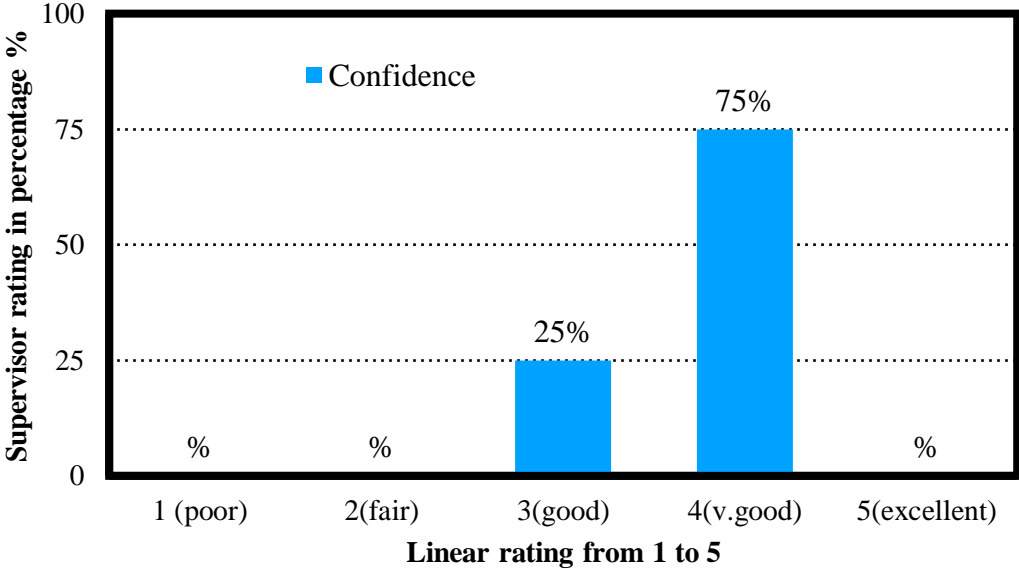


Fig 5.15 Bar Graph showing supervisor's rating for students' confidence developed in acquired skills for project practicum.

Figure 5.15 shows the responses for confidence developed among students for acquired skills in the students while conducting project practicums in assigned groups. As per the rated responses 75% of students rated very good (4), 25% of students rated good (3). It showed that most of the students developed confidence on developing time management skills, teamwork skills, problem solving skills and gained field knowledge. Assigned project practicums were conducted by students in the required time frame, learned time management skills while preparing reports, developed communication skills while working as a team member and bid confidence on gaining field knowledge about the related technical content.

V. Open ended feedback questions

1. What technical knowledge and skills did the students learn during the internship assignment?

2. Suggestions for students to learn and develop technical or industry needed skills which may be helpful in students' future professional career.

Below is the summarized feedback for open ended questions.

1. The supervisors reported that students had gained field knowledge about Ready mix plant, Truck weighing machine equipment used in material procurement procedures, Excavation equipment's needs, requirements, and efficiency. Construction management supervisor reported that students developed the skills like time management and working as a team member. The construction site challenges were also identified by the students and learned to read and understand the construction plans and related specifications. Students learned with construction site supervisors the process of building construction work as per the construction plans. Some of the other construction related activities students learned and monitored at construction site were bar bending schedules, foundation reinforcement, grading of materials, mixing ratios of materials as per design requirements. Hence Internship program's conducted project practicums had given an opportunity for students to gap the bridge between theoretical or classroom knowledge and construction site practicum and scenarios.
2. Site supervisors encouraged the students to participate in such internship programs as it will help them to get knowledgeable and understand the field challenges and scenarios. The students got the opportunity to clarify the concepts of learned theoretical knowledge as they were able to monitor and gauge the field practicums like reinforcement bars in foundations, ready mix concrete plant, pouring of concrete for foundations, building construction and construction management practices. Supervisor had reported significant improvement in students for the construction site activities understanding, level of queries, teamwork skills, problem solving skills, usage of technical terminology while working and interacting with construction site supervisors. Supervisors recommended on encouraging other students to join such

internship initiatives as it will help them to develop knowledge and skills and preparing them as skilled graduate for their future professional careers

5.2.2.3 Statistical analysis for students' feedback for the following parameters of PBL based internship program.

- I. Communication skills (oral)
- II. Communication skills (written)
- III. Problem solving skills
- IV. Teamwork skills
- V. Technical competency Skills
- VI. Open ended feedback questions.

For the present study students conducted practicums for surveying and ground investigation, site excavation, foundation design, foundation and building construction, construction management practices. While conducting practicums students worked in teams and performed their assigned duties as team members. Students did discussions, understood the practicum related content, wrote down queries with site supervisors, noted down the challenges on construction site, discussed the solutions and site challenges and prepared daily and weekly reports together as a team. This experience contributed to develop and improving communication skills as they learned to clearly express their opinions, organize, and put together the relevant ideas in team discussions. Below are the responses expressed by students for the improved and developed skills and knowledge.

Table 5.8

Analysis of student's feedback form for the developed and improved soft and technical competency skills 1 (poor), 2 (fair), 3 (good), 4 very good), 5 (excellent).

Students' linear rating for developed and improved skills in students after conducting project practicums for PBL based internship program							
Main parameters	Functional Parameters	1	2	3	4	5	Average rating out of 5
Communication skills - Oral	Clarity	0%	0%	36%	58%	6%	3.70
	Relevance	0%	9%	33%	46%	12%	3.61
	Organization	0%	6%	42%	31%	21%	3.67
Communication skills - Written	Clarity	0%	0%	30%	61%	9%	3.79
	Relevance	0%	3%	36%	40%	21%	3.79
	Organization	0%	3%	21%	51%	24%	3.93
	Language	0%	0%	42%	46%	12%	3.70
Problem Solving skills	Define	0%	3%	40%	49%	9%	3.67
	Analyses	0%	12%	24%	46%	18%	3.70
	Evaluate	0%	6%	30%	46%	18%	3.76
Teamwork Skills	Rapport	0%	6%	24%	55%	15%	3.79
	Openness	0%	3%	30%	49%	18%	3.82
	Effort	0%	0%	21%	58%	21%	4.00
	Synthesis	0%	3%	27%	52%	18%	3.85
Technical Competency Skills	Understanding	0%	0%	12%	79%	9%	3.97
	Confidence	0%	3%	12%	55%	30%	4.12

I. Communication skills (Oral)

1. Clarity - to clearly express, easily understand, and able to present comprehensibly.

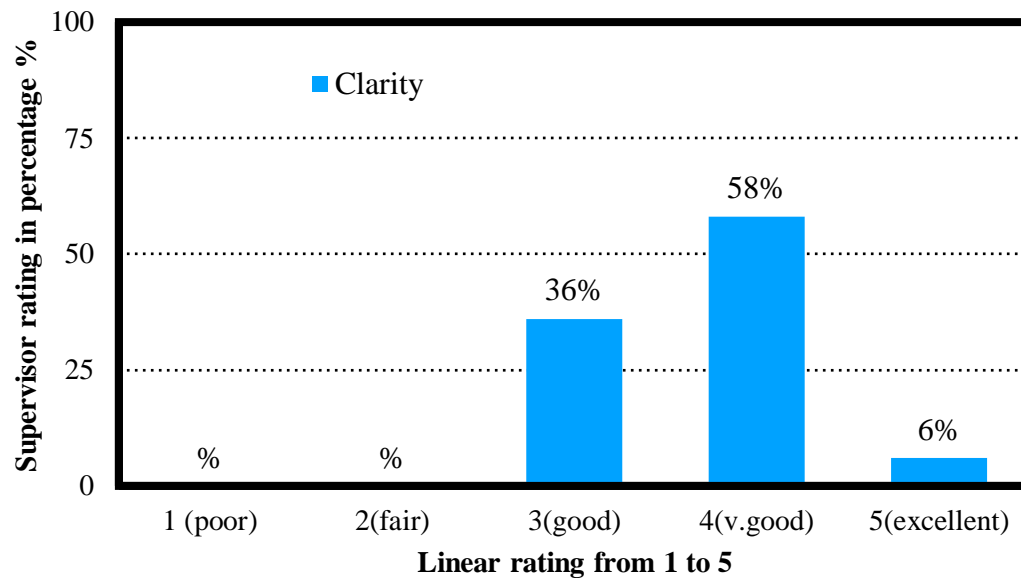


Fig 5.16 Bar Graph showing students rating for clarity in understanding, discussing and presenting technical content of project practicum.

Figure 5.16 shows students responses for their clarity in expressing, understanding and presenting the technical content while working with the assigned group. As per the rated responses 6% of students rated excellent (5), 58% rated very good (4), 36% rated good (3). It showed that most of the students reported for clarity in expressing, understanding, and presenting the technical content for conducted project practicums

2. Relevance - Able to synchronize the material with relevancy

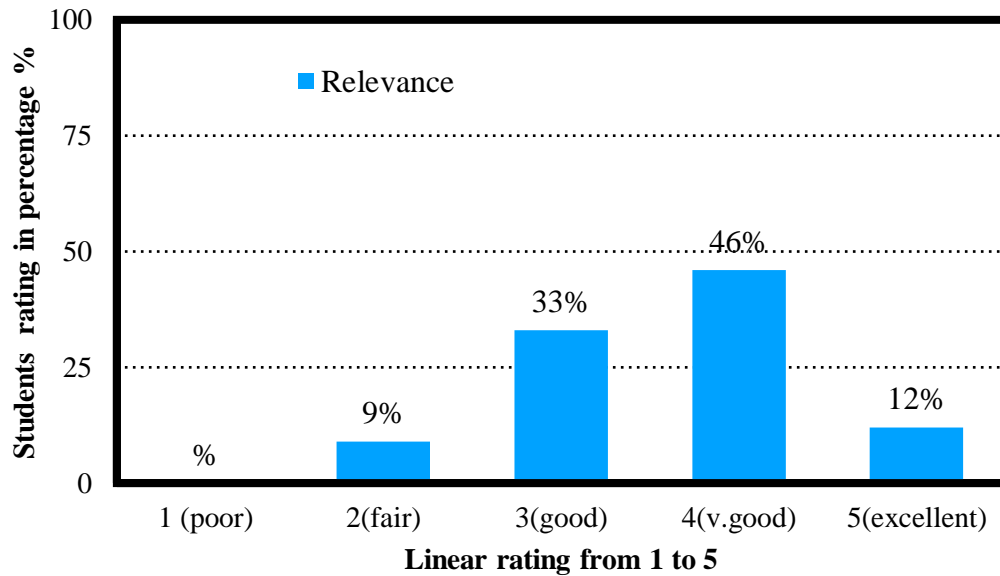


Fig 5.17 Bar Graph showing students rating for synchronizing and identifying relevance of project practicums.

Figure 5.17 shows students responses for relevantly synchronize technical matter for reports while working with the assigned group. As per the rated responses 9% of students rated excellent (5), 46% rated very good (4), 33% rated good (3) and 9% students rated the as fair (2). It showed that most of the students reported relevancy in expressing and presenting technical matter during field practicums.

3. Organization - Logically organize, structure and reasonable approach for report presentation.

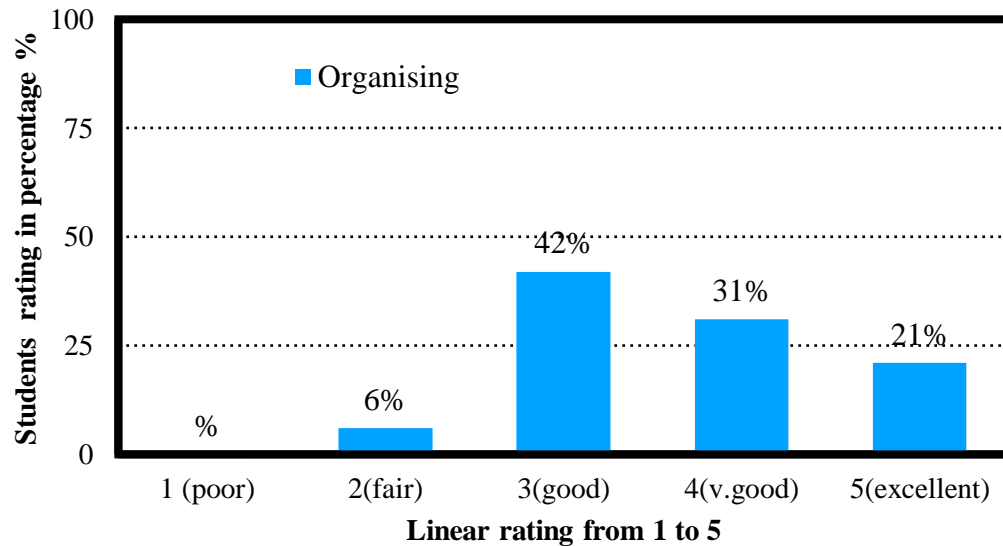


Fig 5.18 Bar Graph showing students rating for understanding and logically organizing technical content of project presentations of conducted project practicum.

Figure 5.18 Students' responses for the effort on logical organizing, structure and reasonable approach for report presentation while working with the assigned group. As per the rated responses 21% of students rated excellent (5), 31% rated very good (4), 42% rated good (3) and 6% students rated the fair (2). It showed that most of the students were able to organize for report presentation structurally and reasonably.

II. Communication skills (written)

1. Clarity - to clearly express, easily understand, and able to present or write comprehensibly.

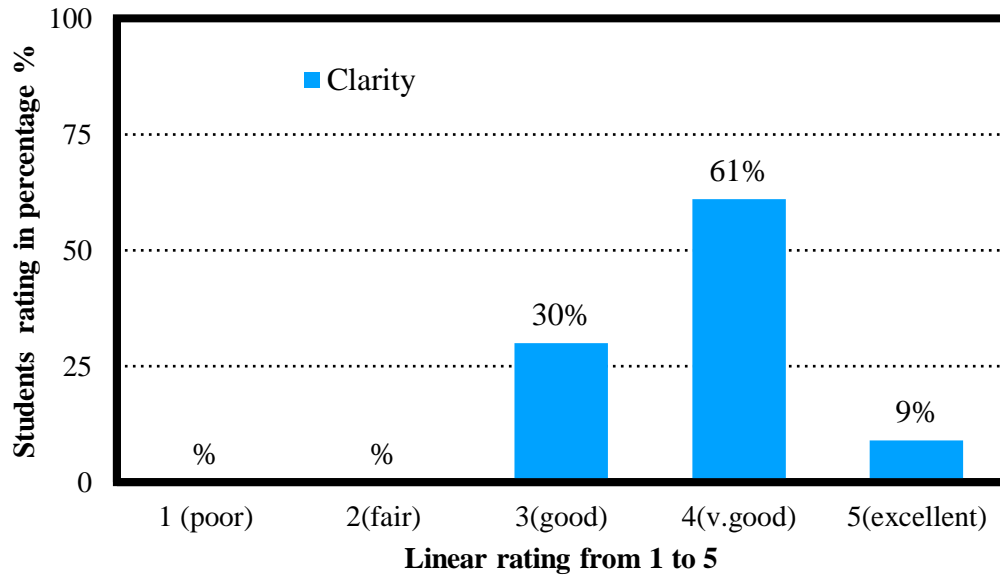


Fig 5.19 Bar Graph showing students rating for developing clarity in understanding, discussing and technical writing of project reports for project practicum.

Figure 5.19 shows students responses in clarity to express, understand and present while working with the assigned group. As per the rated responses 9% of students rated excellent (5), 61% rated very good (4), 30% rated good (3). It showed that most of the students were clear on understanding, expressing for technical writing. The submitted daily reports put together in a more logical and organized way towards the end of internship period as compared to the beginning of internship period which showed improvement in technical writing.

2. Relevance - Able to identify relevant material

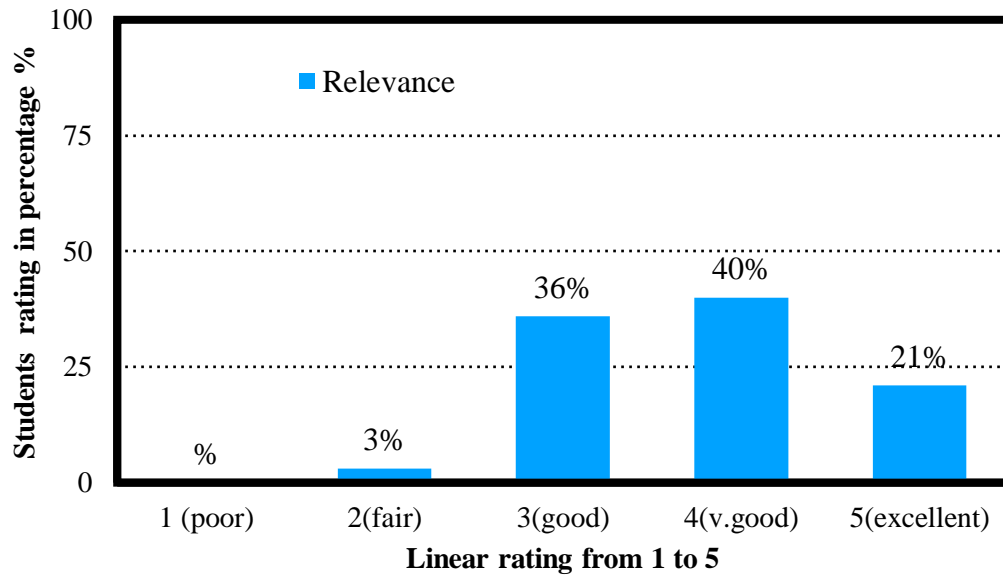


Fig 5.20 Bar Graph showing students' rating for their ability to identify relevance of technical material to the project practicums.

Figure 5.20 shows responses rated for relevancy in identifying, expressing, and presenting technical content while working with the assigned group. As per the rated responses 3% responded fair, 36% rated good (3), 40% of students rated very good (4) and 21% (5) rated excellent. It showed that most of the students were able to identify relevance of technical material to the project practicums for PBL based internship program.

3. Organization - Logically organize, structure and reasonable approach for project report writing.

Students rating for understanding and logically organizing the technical writing for project practicums reports.

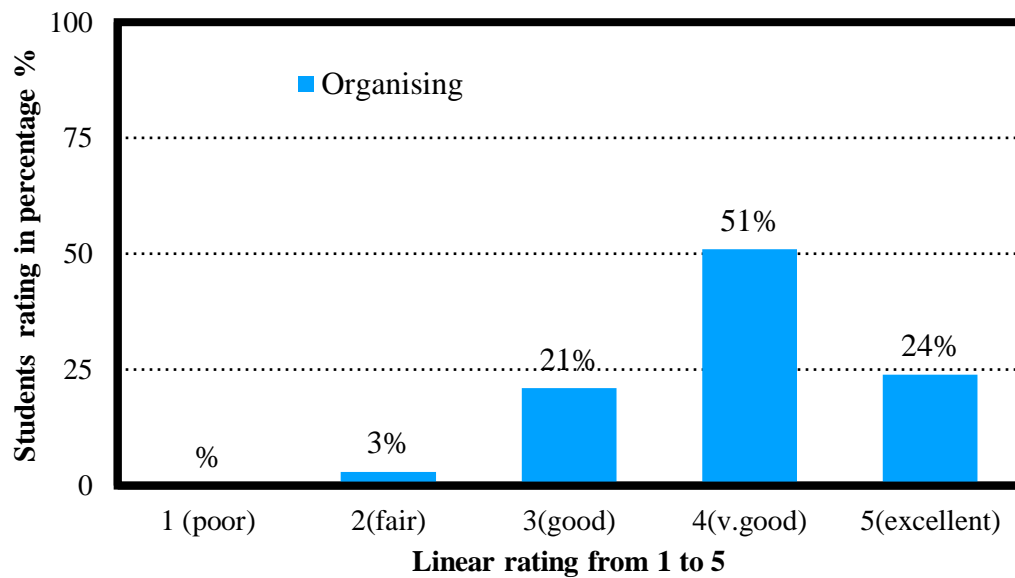


Fig 5.21 Bar Graph showing students rating for understanding and logically organizing the technical writing for project practicum reports

Figure 5.21 shows students responses for logical organizing, structure and reasonable approach for technical writing while working on the project practicum reports. As per the rated responses 24% of students rated excellent (5), 51% rated very good (4), 21% rated good (3) and 3% students rated the as fair (2). It showed that students can be able to logically structure, organize the technical content for report writing

4. Language - To use appropriate technical language and construction of sentences.

Students rating for appropriate technical language for construction of sentences for technical writing for project practicums reports.

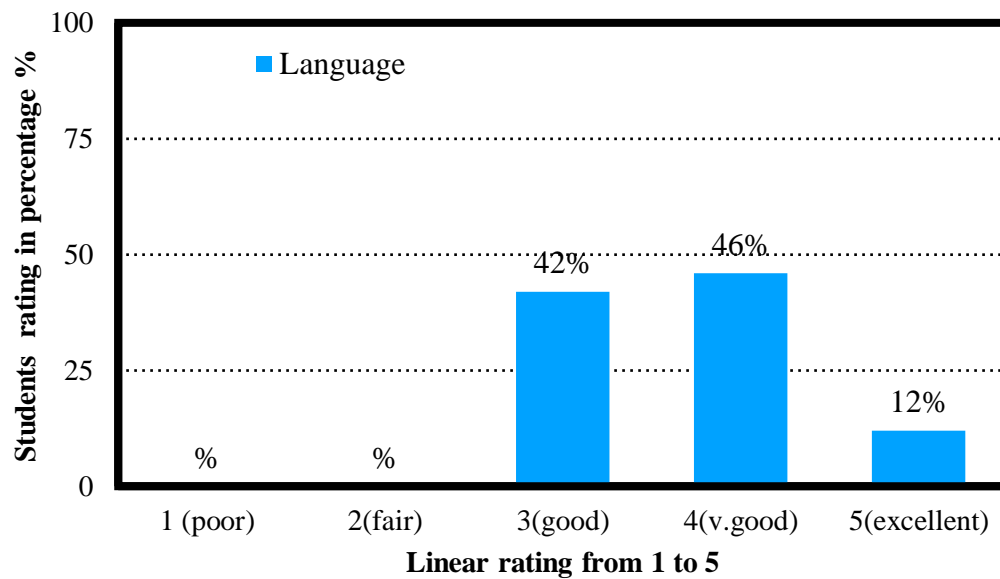


Fig 5.22 Bar Graph showing students rating for appropriate technical language for writing project practicums reports.

Figure 5.22 shows responses for using appropriate technical language for construction of sentences while preparing project practicum reports. As per the rated responses 12% of students rated excellent (5), 46% rated very good (4), 42% rated good (3). It showed that most of the students reported the learning in using appropriate language and sentences for technical report writing and project presentations for internship program.

III. Problem Solving skills

1. Define - Conceptualizes problems with peers in a workable and manageable manner.

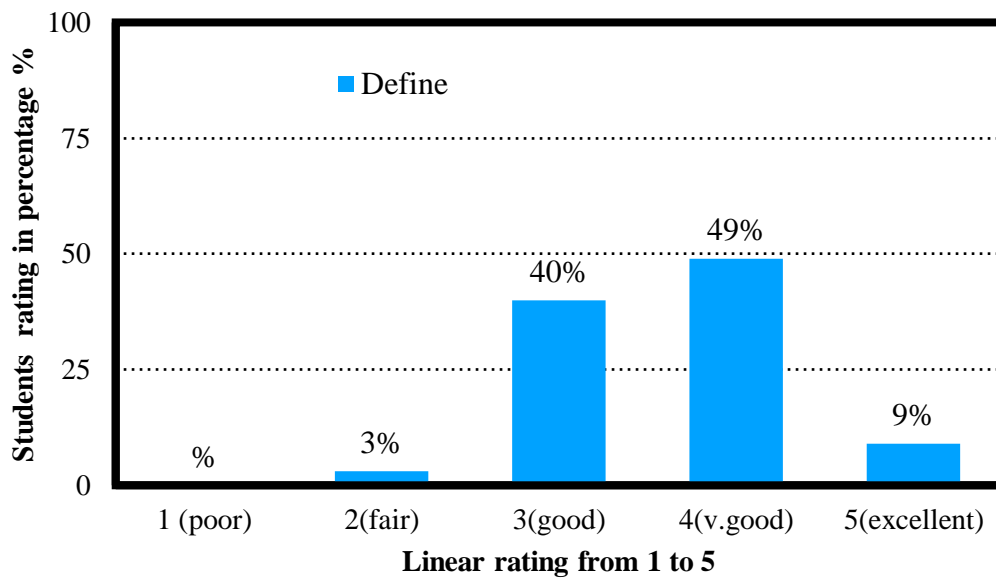


Fig 5.23 Bar Graph showing students rating for defining and conceptualizing the problems and challenges while conducting project practicums

Figure 5.23 shows how did respondents rated for student conceptualizing problems with peers while working with the assigned group. As per the rated responses 9% of students rated excellent (5), 49% rated very good (4), 40% rated good (3) and 3% students rated the as good (2). It showed that most of the students did collaborate with peers in a workable and manageable manner while conceptualizing problems.

2. Analyze - Breaks down into questions for significant and discussions with supervisors.

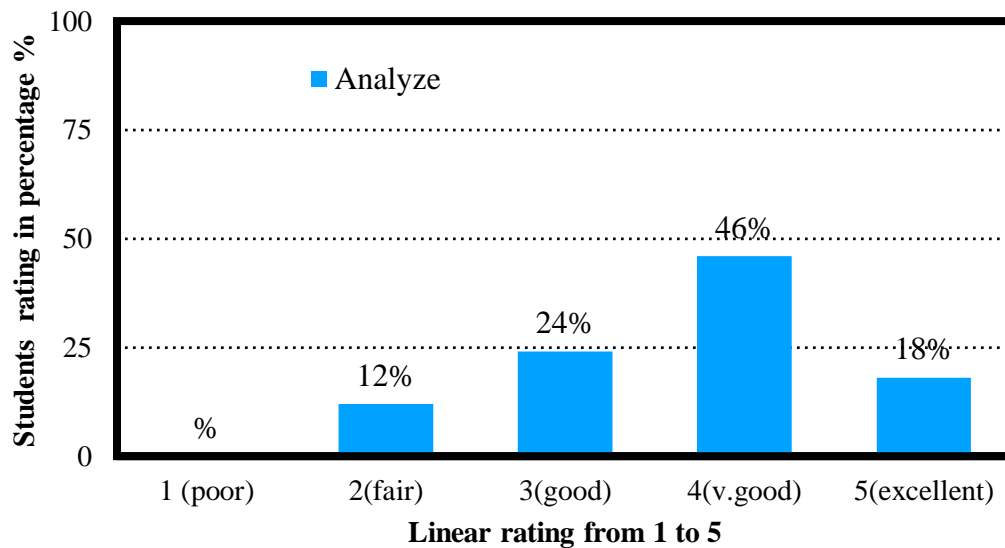


Fig 5.24 Bar Graph showing students rating for breaking down the questions for significant and productive discussions with supervisors for project practicums.

Figure 5.24 shows responses rated for breaking down the questions for significant and productive discussions with supervisors for project practicums. As per the rated responses 18% of students rated excellent (5), 46% rated very good (4), 24% rated good (3) and 12% students rated the as fair (2). It showed that most of the students reported on analyzing the critical and significant components of field practicum while doing discussions with supervisors.

3. Evaluate - Understand and validates the learning with peers and supervisors.

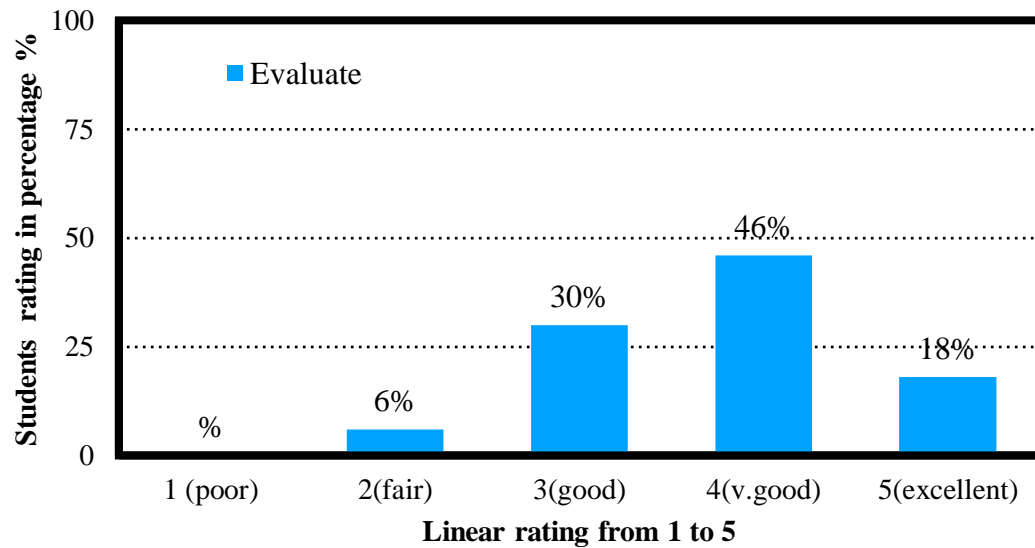


Fig 5.25 Bar Graph showing students rating for understanding and validating learning discussions with team members and supervisors

Figure 5.25 shows students responses for understanding, evaluating and validating the learning with team members and site supervisors conducting project practicums. As per the rated responses 18% of students rated excellent (5), 46% rated very good (4), 30% rated good (3) and 6% students rated the as fair (2). It showed that most of the students were able to interact with team members and site supervisors and learned from discussions with peers and supervisors.

IV. Teamwork Skills

1. Rapport - Demonstrates integrity in teamwork.

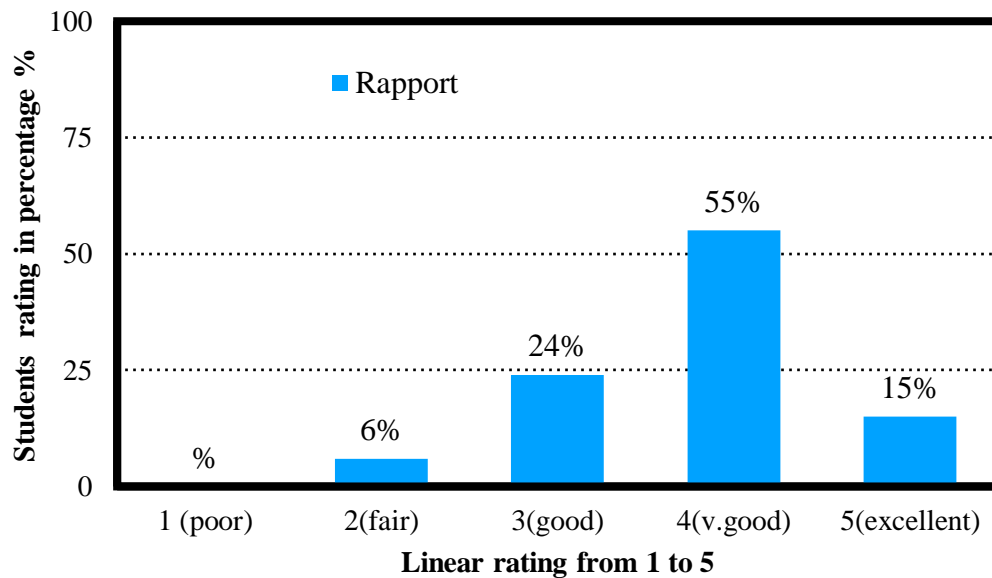


Fig 5.26 Bar Graph showing students rating for demonstration of integrity in teamwork for project practicums.

Figure 5.26 shows students responses for rapport in building relationships and demonstrate respect with peers while working with the assigned group. As per the rated responses 15% of students rated excellent (5), 55% rated very good (4), 24% rated good (3) and 6% students rated the as fair (2). It showed that most of the students reported on learning to build relationships by respecting the team members opinions.

2. Openness - Works productively with diverse perspectives as team member in assigned group.

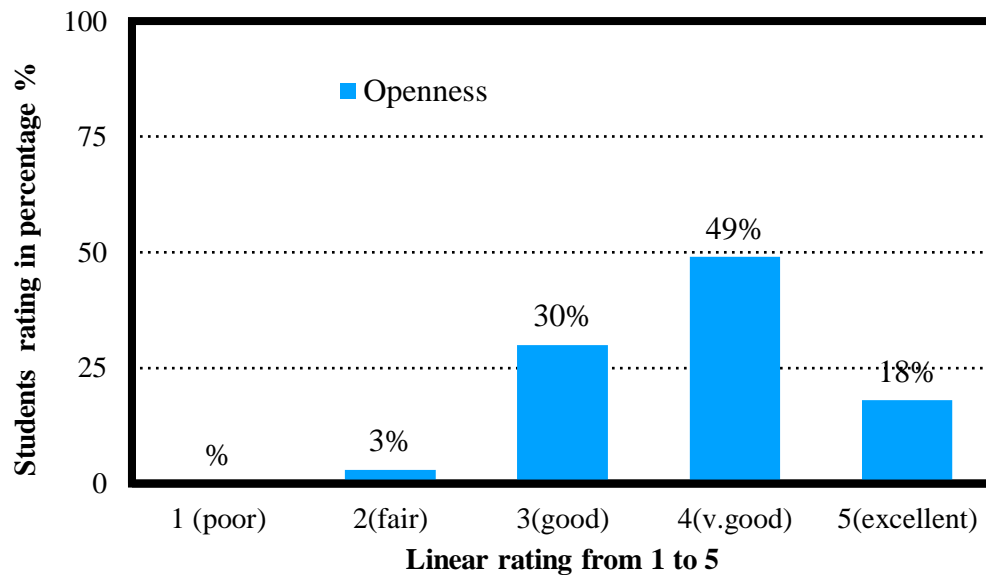


Fig 5.27 Bar Graph showing students rating for openness and working productively in a team for project practicums.

Figure 5.27 shows students responses for the openness and work productiveness while collaborating with the team members. As per the rated responses 18% of students rated excellent (5), 49% rated very good (4), 30% rated good (3) and 3% students rated the as fair (2). It showed that most of the students reported student openness and work productiveness even while having diverse perspectives of team members for an assigned group.

3. Effort - Does fair share in the group work.

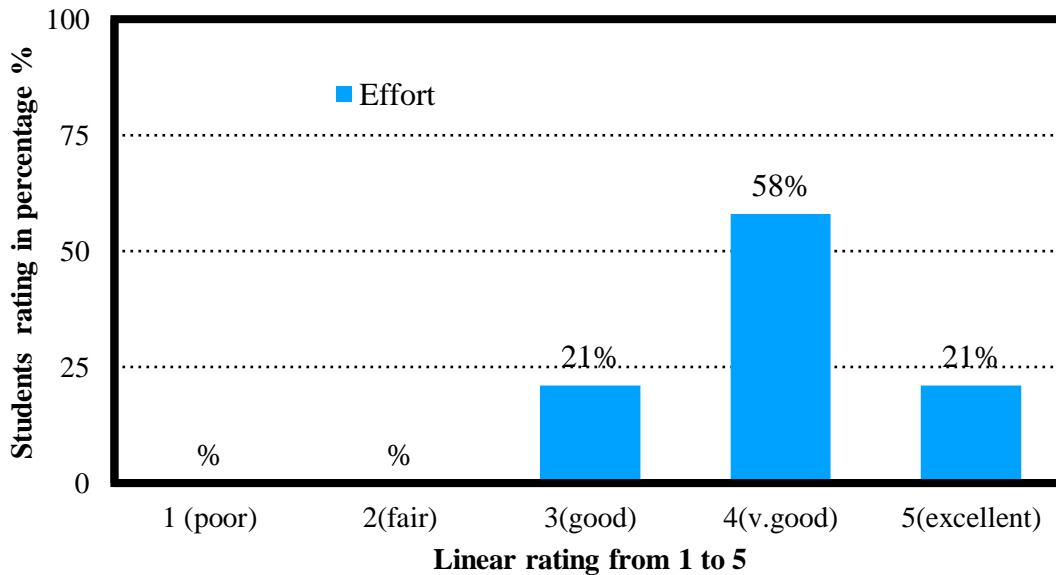


Fig 5.28 Bar Graph shows students rating for contributing fairly in sharing teamwork while conducting project practicums.

Figure 5.28 shows students responses on the effort by team members in doing fair share of work while working with the assigned group. As per the rated responses 21% of students rated excellent (5), 58% rated very good (4) , 21% rated good (3). It showed that most of the students reported fair effort done by team members to share and distribute the work responsibilities in a team. Students worked as a team and learned to work as team member by dividing the fair share of responsibilities

during project practicums, taking notes, preparing reports, and timely submitting them.

4. Synthesis - Pulls together ideas, focuses on thoughts, draws conclusions with peers as a team member.

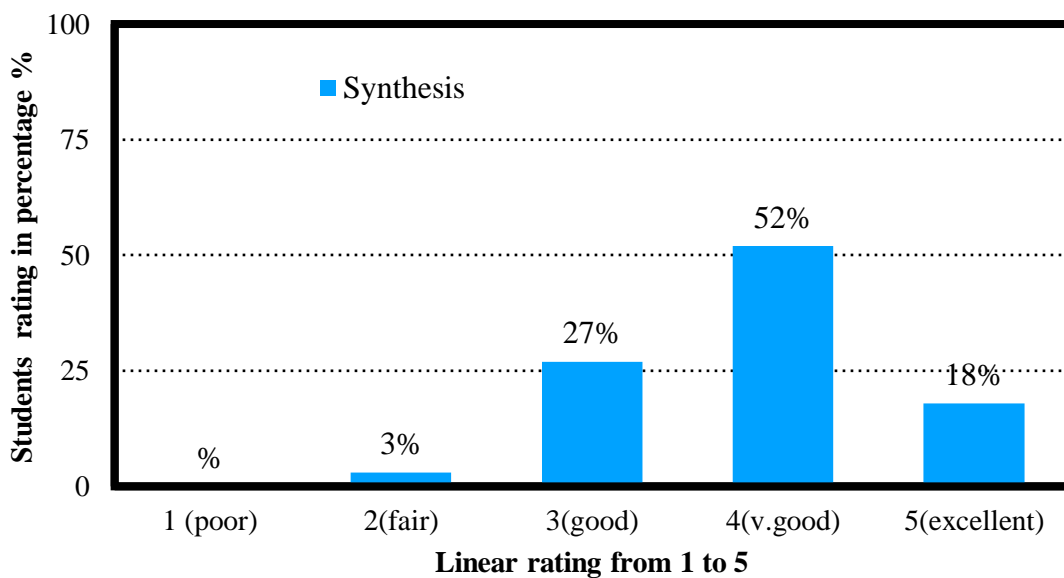


Fig 5.29 Bar Graph showing students rating on pulling ideas, focus and drawing conclusions during teamwork for project practicums

Figure 5.29 shows students responses for synthesis in pulling ideas and drawing conclusions while working with the assigned group. As per the rated responses 18% of students rated excellent (5), 52% rated very good (4), 27% rated good (3) and 3% students rated the as fair (2). It showed that most of the students reported

that the ability to think, focus on ideas and contributed while drawing conclusions. with peers as team members.

V. Technical Competency Skills

1. Understanding Skills - Current level of understanding skills specific to internship program.

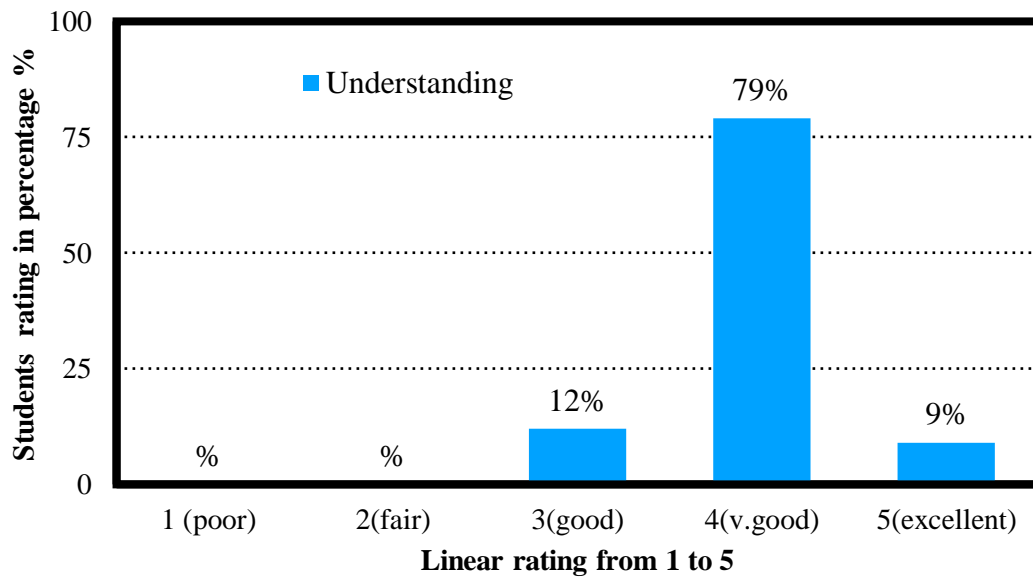


Fig 5.30 Bar Graph showing students rating for their understanding skills related to technical content and site scenarios of project practicums.

Figure 5.30 shows that students reported they understand the concept of theory content in a better way when the field exposure was provided in the form of PBL internship project practicums. As per the rated responses 9% of students rated excellent (5), 79% rated very good (4), 12% rated good (3). It showed that most of the students reported on attained understanding the technical content of field practicums and reflect with the learned theoretical course work which results in gaining field knowledge or improvement in technical competence of students.

2. Confidence - Current level of confidence in skills and abilities like professionalism, knowledge of field activities and time management.

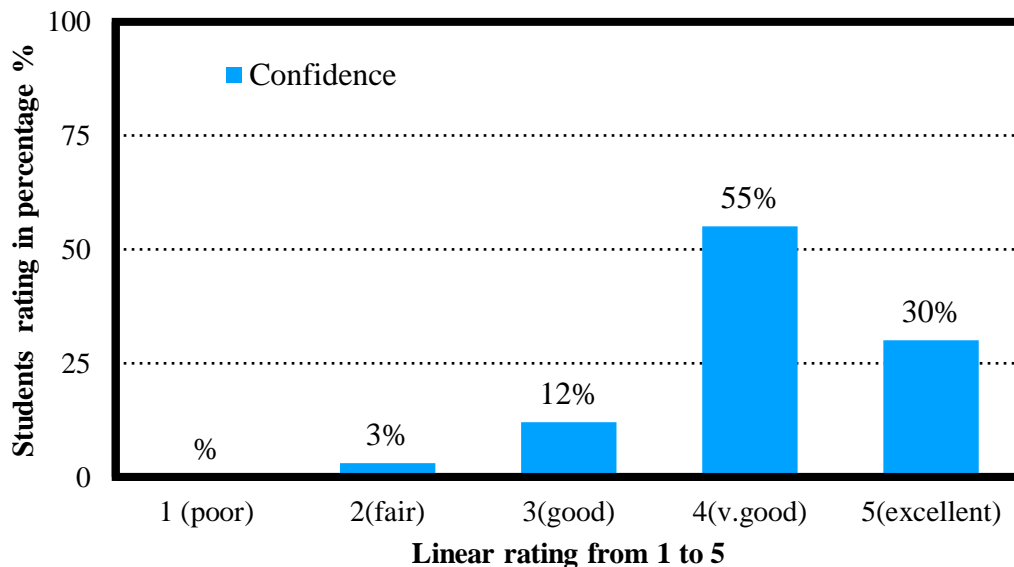


Fig 5.31 Bar Graph showing students rating for achieving confidence in acquired knowledge and skills for project practicums.

Figure 5.31 shows the responses for *achieving confidence in acquired knowledge and skills for project practicums*. As per the rated responses 30% of students rated excellent (5), 55% rated very good (4), 12% rated good (3) and 3% students rated the as fair (2). It showed that most of the students developed confidence on developing time management skills, teamwork skills, problem solving skills and gaining field knowledge.

VI. Open ended feedback questions.

Students had provided the feedback for following open ended questions after conducting the project practicums for PBL based internship program. The parameters for open ended questions were decided on the basis of students' responses received for the open-ended questions and those responses were categorized into four major categories and the percentage of each category depicts the similar responses received for that particular category.

Table 5.9

Illustrates the students feedback responses for experience in attending PBL based internship experience.

How much internship experience affected in clarifying your career plans and goals?				
Not at all	Somewhat	Moderately	Great Extent	High
0%	3%	21%	76%	0%

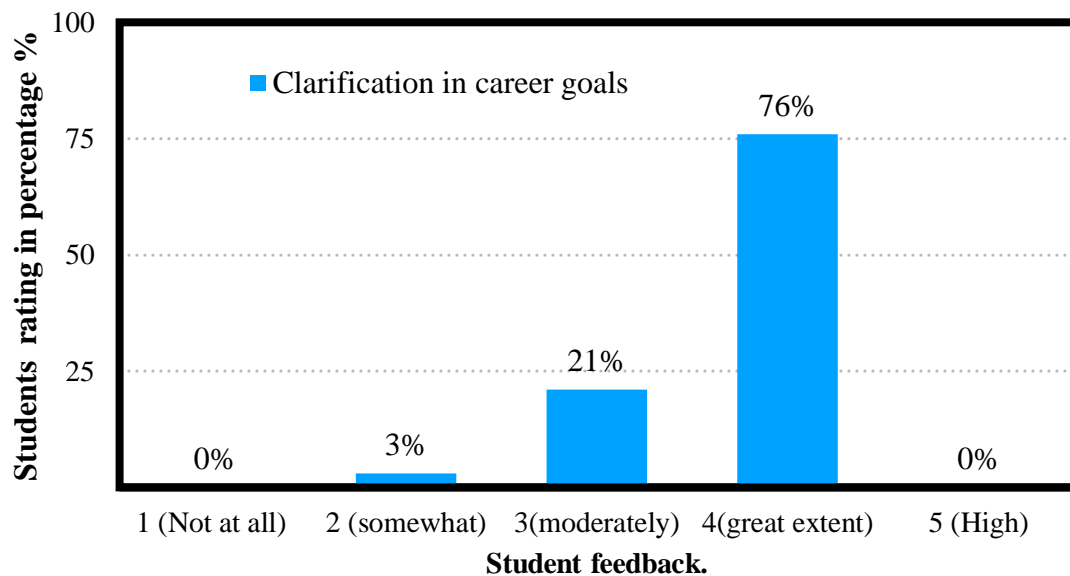


Figure 5.32 Bar graph depicting the responses for the impact of attended field experience on clarifying student's career plans and goals.

Figure 5.32 showed the participants response in clarifying career plans and goals while conducting group project activities. 76% of students responded to great extent, 21% as moderate impact. Considering the results, one could state that participants had explored the different verticals of civil engineering while conducting different group project activities in the field and which helped in identifying a directional vision to proceed further in their professional career

Table 5.10

Illustrates the students’ responses on new technical skills for conducted project practicums.

What new technical skills did you acquire as a result of PBL based internship program experience?			
Field Knowledge	RMC, Primavera	Find equipment knowledge	NA
58%	18%	21%	3%

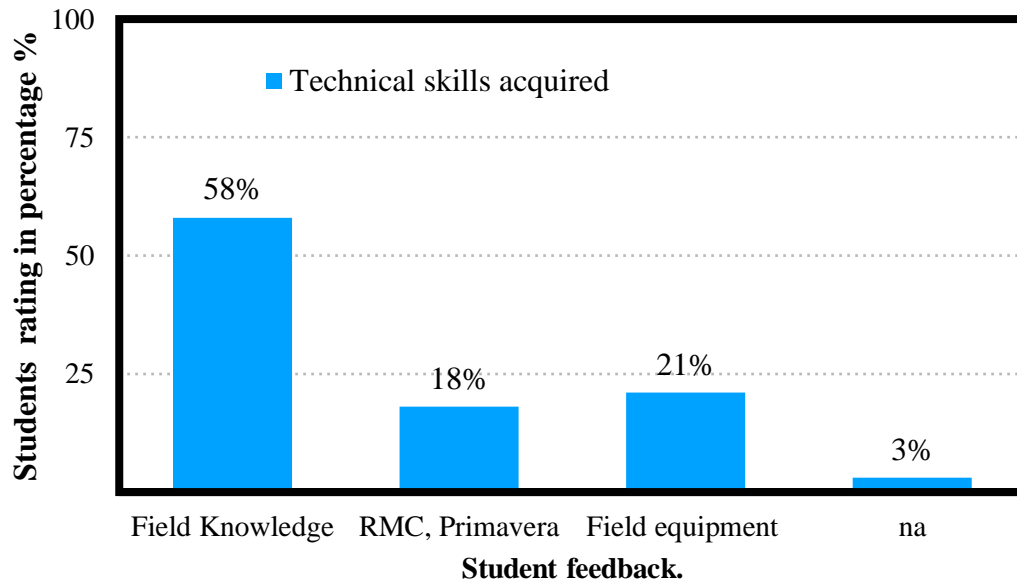


Fig. 5.33 Bar chart source depicting the responses for the new technical skills students acquired because of attending PBL based internship program experience.

Figure 5.33 showed the participants responses for the new technical skills acquired as a result of your internship experience. 58% responded as Field knowledge 18% responded as RMC, BBS, SCADA, 21% as field equipment knowledge, read, understand construction plans while 3% did not respond.

Table 5.11

Illustrates the students' feedback for the learning accomplishments after conducting PBL based internship period.

What were your project related or personal accomplishments after conducting project practicums for PBL based internship program?			
Field scenarios knowledge	Soft skills - Report writing, Decision making, Management skills, Punctuality	GERI, RMC, Precast, Site Plans Project practicums	na
46%	24%	15%	15%

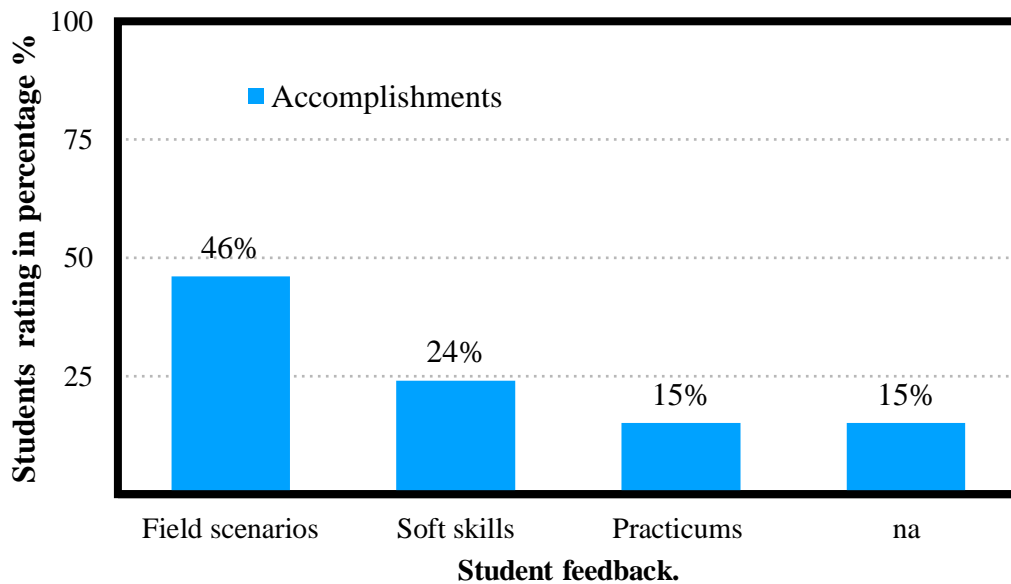


Fig 5.34 Bar chart depicting the responses for the project related accomplishments after conducting project practicums

Figure 5.34 showed the participants responses for the project related or personal accomplishments while on internship period. 46% of students chooses Field scenarios knowledge, 24% responded for soft skills report writing, decision making, management skills, punctuality, 15% as practicums at GERI, RMC, Precast, Site plan while 15% did not respond.

Table 5.12

Illustrates the students' feedback on ways curriculum courses were beneficial in PBL based internship program.

In what ways were curriculum courses beneficial in preparing students for this PBL based internship program?			
Background theory information	Basic course work	Basic knowledge of foundation and building designs	na
40%	24%	24%	12%

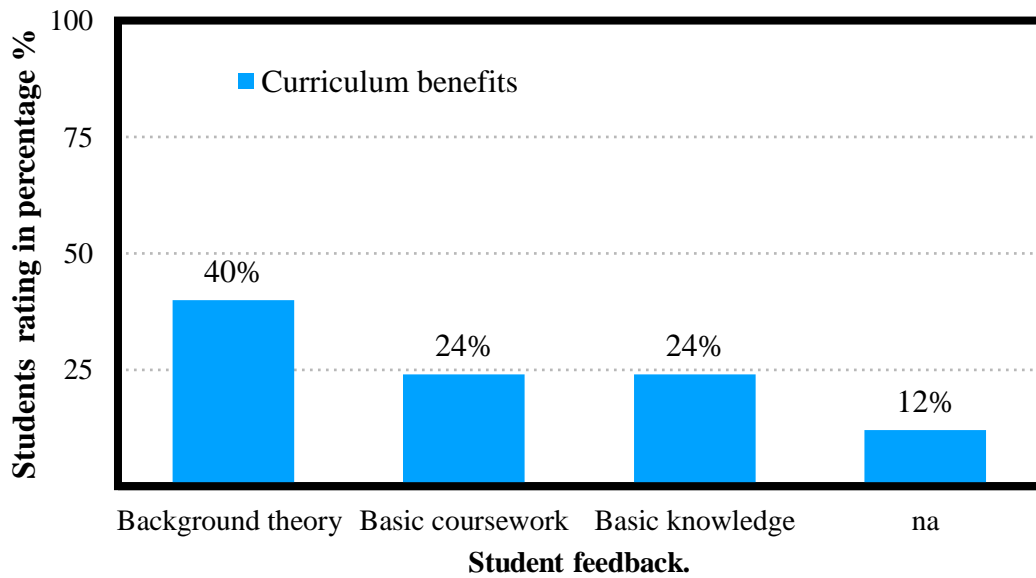


Figure 5.35 Bar chart depicting the students' responses for the benefits of curriculum courses in preparing them for PBL based internship experience.

Figure 5.35 showed the students response for the curriculum courses beneficial in preparing for this PBL based internship experience. 40% of students chooses

background theory and information, 24% responded for basic course work theory learned in the classroom, 24 % as basic knowledge of foundation and building designs while 12% did not respond.

Table 5.13

Illustrates the students’ feedback for the learning about equipment, tools or software applications during PBL based internship program.

What equipment, tools or software applications were learned during PBL based internship program?			
Equipment knowledge – Details about Excavator equipment	Industry Software Primavera, MS Project, MS Office, AUTOCAD,	Industry manuals GERI Manuals, RMC Processes	na
34%	42%	24%	0%

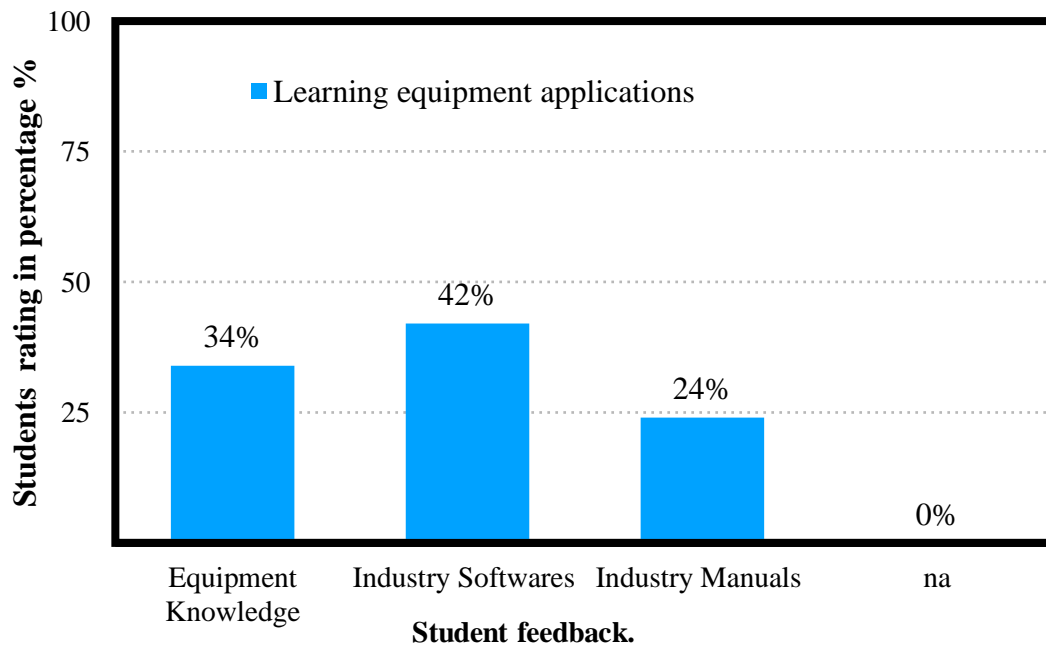


Figure 5.36 Bar chart depicting the responses for the equipment, tools or software applications that were learned during PBL based internship program.

Figure 5.36 showed the students response for the equipment, tools or software applications that were learned during PBL based internship program. 34% of the students mentioned the detailed knowledge about excavators' equipment, 42% of students chooses Primavera software for project management, MS Project, MS Office, AUTOCAD, technical report writing, 24% responded for learning Manuals and construction procedures at Gujarat engineering research institute, RMC (Ready MIX Concrete) processes.

Table 5.14

Illustrates the feedback for learning during the field experience was different from the traditional classroom learning.

What have you learned through your PBL based internship experience that is not traditionally learned in the classroom?			
Soft skills	Technical Field knowledge	Site scenarios and challenges	na
36%	43%	21%	0%

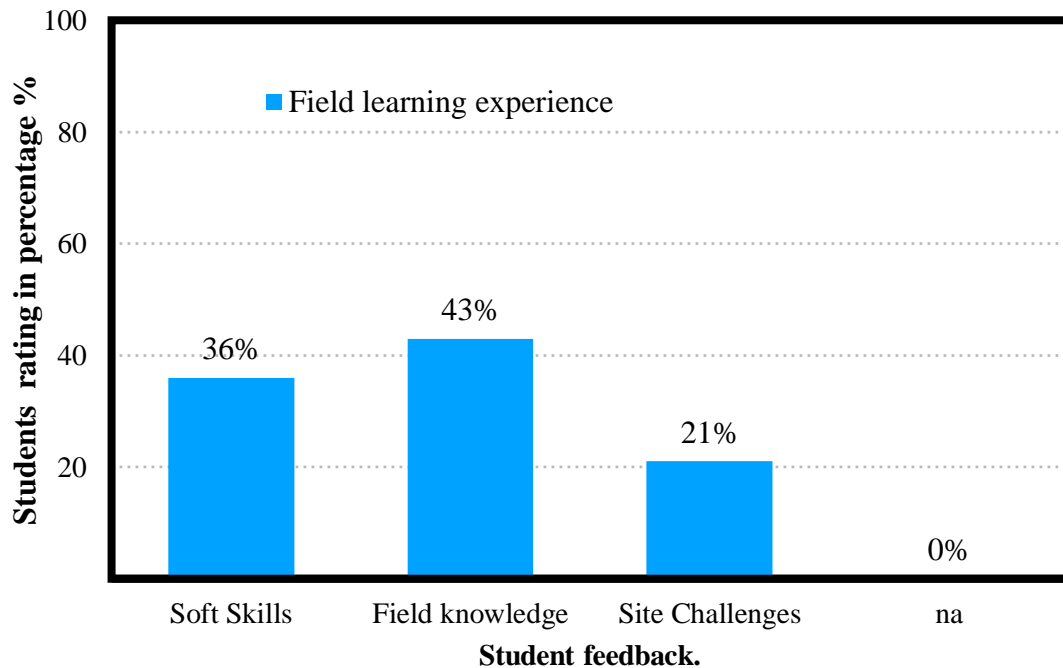


Figure 5.37 Bar chart source depicting the responses for the learning experience

was different from the traditional classroom learning for PBL based internship program.

Figure 5.37 showed the students responses about their difference in learning different skills and field scenarios during the PBL based internship program as compared to traditional classroom learning. 36% of the students mentioned about learning soft skills, 43% responded for technical field knowledge and 21% responded for identifying site challenges.

Table 5.15

Illustrates the feedback responses received for the theoretical concepts applied during your internship program.

What classroom learned theoretical concepts or conceptual knowledge did you apply during your PBL internship program practicums?			
BBS, RMC, Mixers, Steel design	Understand foundation and building drawings	Soil testing, Excavation procedures.	na
42%	24%	31%	3%

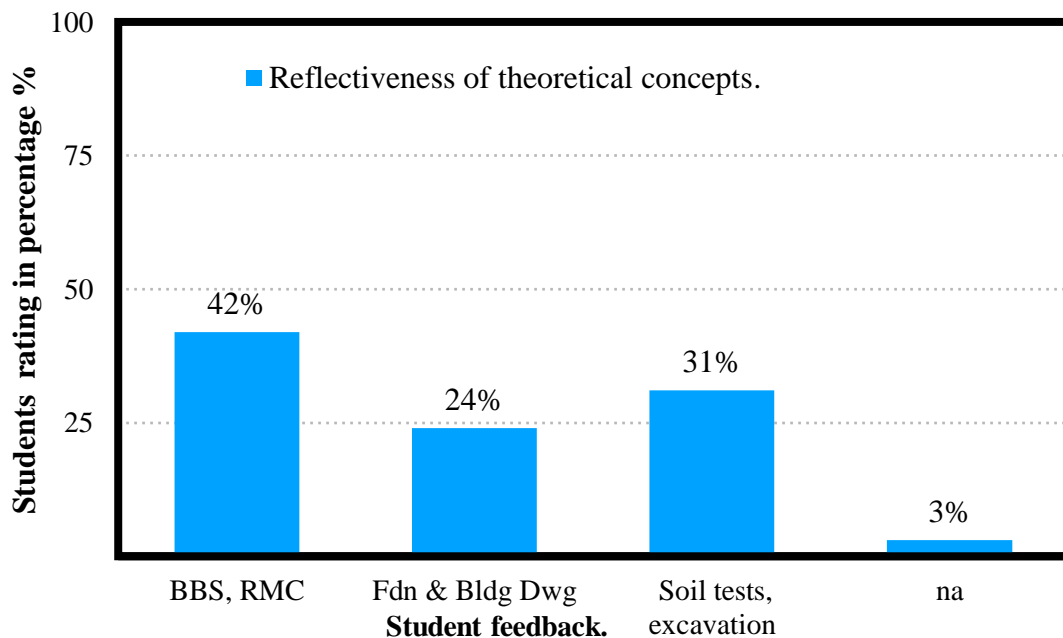


Figure 5.38 Bar chart source depicting the responses for applying classroom learned theoretical concepts as applied during PBL based internship program practicums.

Figure 5.38 showed the students responses for applying classroom learned theoretical concepts as applied during PBL based internship program practicums. 42% of the students mentioned BBS, RMC, Concrete mixers, Steel reinforcement design, 24% specifies the learning on reading and understanding construction plans, and 31% responded for soil testing and excavation procedures.

Table 5.16

Illustrates the students feedback responses for the best learning aspect of this attended PBL based internship program's experience.

What do you consider the best learning aspect of this experience of attended PBL based internship program?			
Practical knowledge construction activities, site challenges.	Construction software, management skills	Soft skills teamwork, communication problem solving	na
54%	24%	19%	3%

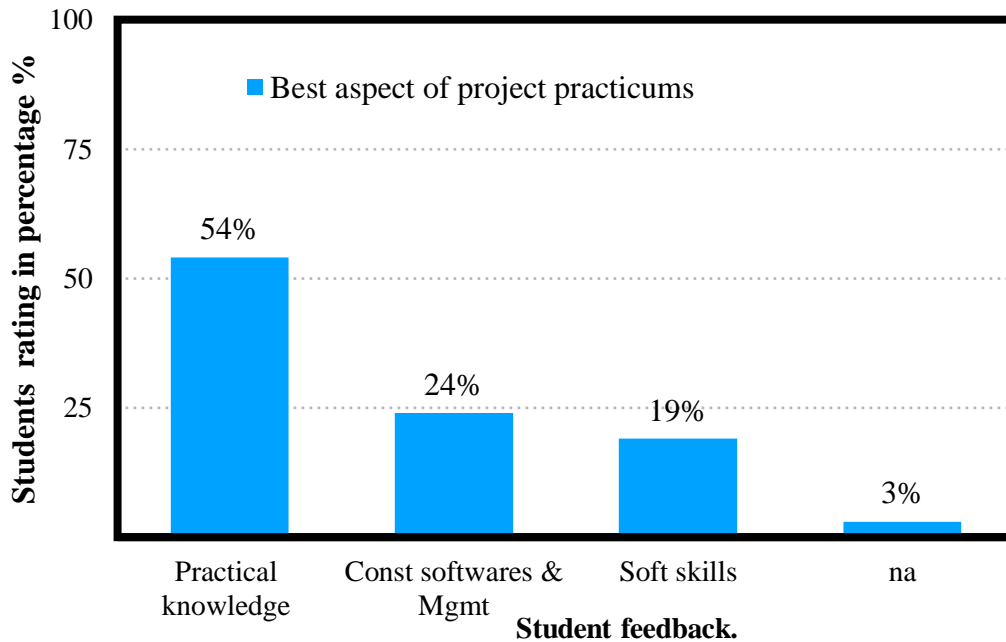


Figure 5.39 Bar chart depicting the students' responses for the best learning aspect of this experience of attended PBL based internship program.

Figure 5.39 showed the students responses for the learning aspect of this experience of attended PBL based internship program. 54% of the students mentioned gain in practical knowledge about construction activities, site challenges, 24% responded learning construction soft wares, construction management skills and 19 % responded for soft skills like teamwork, communication, and problem-solving skills while 3 % did not respond.

5.2.2.4 Researchers observations on students' interaction, involvement while conducting project practicums of PBL based Internship program.

The following points depicted the summary of observations, observed and noted by the researcher during the implementation of Project based learning internship program.

- All the students and team members participated in the field practicum activities.
- Researcher had observed the significant improvement in students for using appropriate technical terminology and identifying the details of construction activities from the site orientation day (beginning) to last phase (end) of internship program.
- Students had chosen team leader for their respective teams and responsibilities were equally shared by all the team members for listing down inquiries for assigned field practicum, notes for report writing, taking pictures, discussions with site supervisors, identifying challenges during observation and monitoring a group discussion as a team at the end of each day.
- Students had shown great enthusiasm, cooperativeness while measuring and investigating the site utilities for site plan and ground investigation practicums.
- Students followed construction site safety regulations quite well and were responsible to collect, submit and sign off daily for the provided safety equipment like hard hats and masks.

- Students improved their technical competency or field knowledge by reflecting on the classroom learning while reading and understanding construction drawings and visualizing the transformation from design drawings to construction site scenarios.
- Students had improved significantly on the technical writing skills. Researcher had observed the growth in technical writing in daily group reports and individual weeks reports.
- Researcher observed the students learned to manage time by finishing the assigned practicum and submitting the daily and weekly reports in the provided period.
- The confidence and communication skills while interacting with researcher and the site supervisor had improved significantly. In small groups students felt more connected to ask and discuss the queries with the team members, site supervisors and researcher.
- Researcher also observed students were punctual and disciplined during project practicums.
- Students interacted with daily laborers and their families for site safety requirements learned during construction management practicums.
- Researcher observed students or team members had taken the decision of assigning penalty or more responsibilities while tackling with uncooperative team members.
- Students had worked with and assisted the site supervisors for unexpected situations of caving in for excavation and foundation construction which contributed to developing problem solving skills and time management skills while tackling this kind of construction site challenges.
- Students gained knowledge about materials procurement, waste reduction, proper handling and storing of materials. The researcher observed the gained knowledge reflectiveness when few students identified some mishandled material on the construction site and inquired that concern with site supervisors.

- Students monitored the bar bending mesh formed on construction site with bar bending schedule drawings and monitored the installation of bar bending mesh for the construction of foundations.
- Students monitored the RMC plant mixing process and learned SCADA software as how to operate it automatically.
- Students followed the quality control procedure in a team to identify the quality of construction materials used at the site.

5.2.2.5 Post site visit questionnaire

Students had provided the feedback for following post or delayed site visit questionnaire for the retention of field knowledge for the conducted project practicums for the attended PBL based internship program.

- How does the post site visit inquiries related to project site activities were more technically specific and meticulous as compared the inquiries during conducting project practicums of PBL based internship program?
- How observantly you were able to identify the safety violation for the ongoing construction site activities during your post site visit as compared to while conducting project practicums of PBL based internship program?
- How satisfied are you with your improvement in identifying construction details for the ongoing construction site activities during post site visit?
- How satisfied are you with for reflectiveness of your field knowledge on the post site visit gained during conducting project practicums for PBL based internship program?
- How familiar and confident are you during post site visit with reading and interpreting construction drawings post internship program?
- How relevant was the field knowledge gained during internship program to identify the different construction activities during post site visit after the gap of three months?
- To what extent do you agree with the following statement: "Exposure and Practical skills acquired through my internship program made me confident while choosing and working on classroom projects."

- How much relevancy you felt of experience gained while conducting project practicums of PBL based internship experience to post site visit?

Table 5.17

Illustrates the students feedback responses for their post site visit inquiries for PBL based internship program.

How does the post site visit inquiries related to project site activities were more technically specific and detail oriented as compared the inquiries during conducting project practicums of PBL based internship program?		
Observant	Moderately	Very less Observant
56	44	0

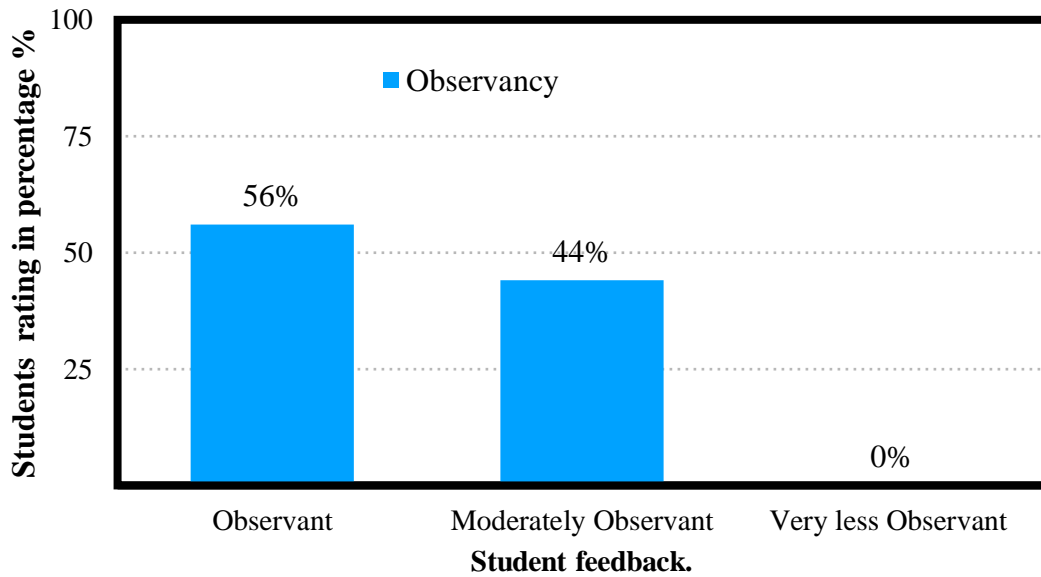


Figure 5.40 Bar chart depicting the students' responses for their post site visit inquiries as more technically specific, and detail oriented for the project practicum.

Figure 5.40 showed the students responses as rating for the observant level of technically specific and detailed oriented during post site visit inquiries as compared the project practicums inquiries while attending PBL based internship program. 56

% students responded as observant, 44% responded as moderately observant for the observant level of technically specific and detailed oriented during post site visit inquiries.

Table 5.18

Illustrates the students feedback responses for identifying the safety violation for ongoing construction site activities during post site visit.

How observantly you were able to identify the safety violation for the ongoing construction site activities during your post site visit as compared to while conducting project practicums of PBL based internship program?		
Observant	Moderately	Very less
56	44	0

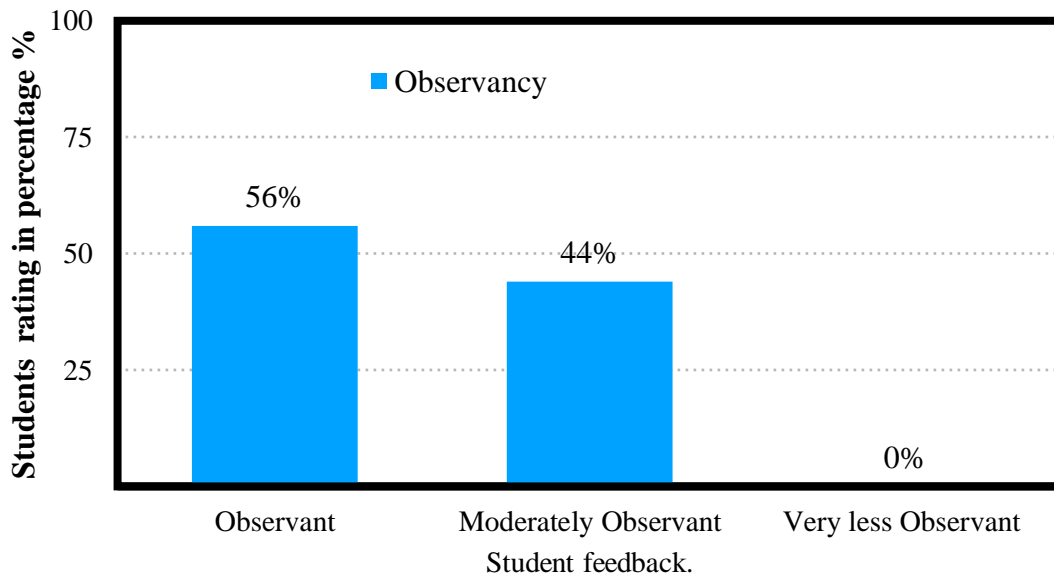


Figure 5.41 Bar chart depicting the responses for the for identifying the safety violation for the ongoing construction site activities during post site visit.

Figure 5.41 showed the students response for identifying the safety violation for the ongoing construction site activities during post site visit. 56% students responded as observant, 44% responded as moderately observant for identifying safety violations post construction site visit

Table 5.19

Illustrates the student’s feedback for reflectiveness of gained field knowledge during post site visit.

How satisfied are you with for reflectiveness of your field knowledge on the post site visit gained during conducting project practicums for PBL based internship program?		
Satisfied	Fairly satisfied	Dissatisfied
71	29	0%

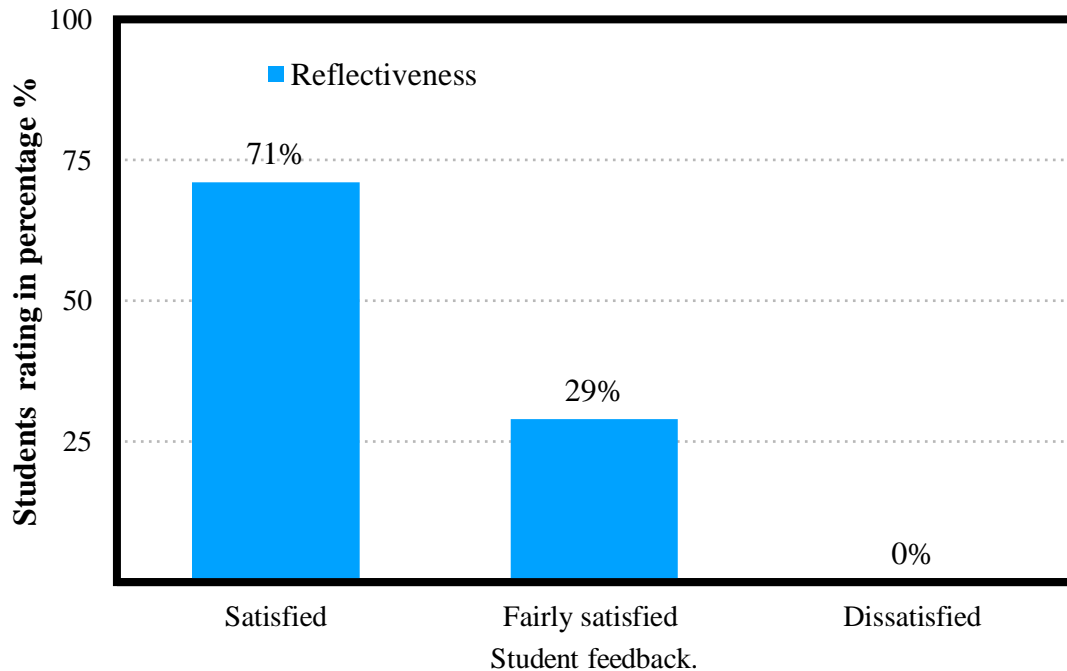


Figure 5.42 Bar chart depicting the responses for the reflectiveness of gained field knowledge during conducting site visit.

Figure 5.42 it showed the participants response improvement in identifying construction details for the ongoing construction site activities post internship program. 71% students responded as satisfied, 29% responded as fairly satisfied for their reflectiveness of gained field knowledge for post internship program.'

Table 5.20

Illustrates the students feedback responses for familiarity and confidence during the post site visit.

How familiar and confident are you during the post site visit in reading and interpreting construction drawings after the gap of three months of conducted project practicums for PBL based internship program?		
Confident	Moderately confident	Very less confident
49	51	0%

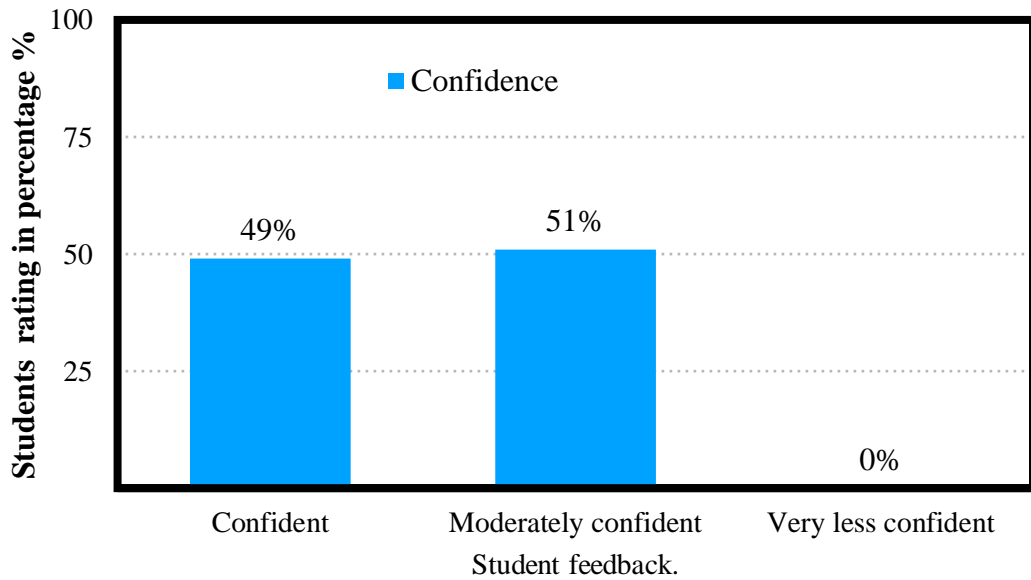


Figure 5.43 Pie chart depicting the students' responses for familiarity and confidence during post site visit in reading and interpreting construction drawings.

Figure 5.43 showed the students responses for familiarity and confidence during most site visit in reading and interpreting construction drawings. 49 % students responded as confident, 51% responded as moderately confident in reading and interpreting construction drawings.

Table 5.21

Illustrates the students' feedback for identifying the different construction activities during conducting project practicums.

How relevant was the field knowledge in identifying the different construction activities during post site visit gained during conducting project practicums for PBL based internship program?		
Relevant	Fairly relevant	Non-relevant
61	39	0%

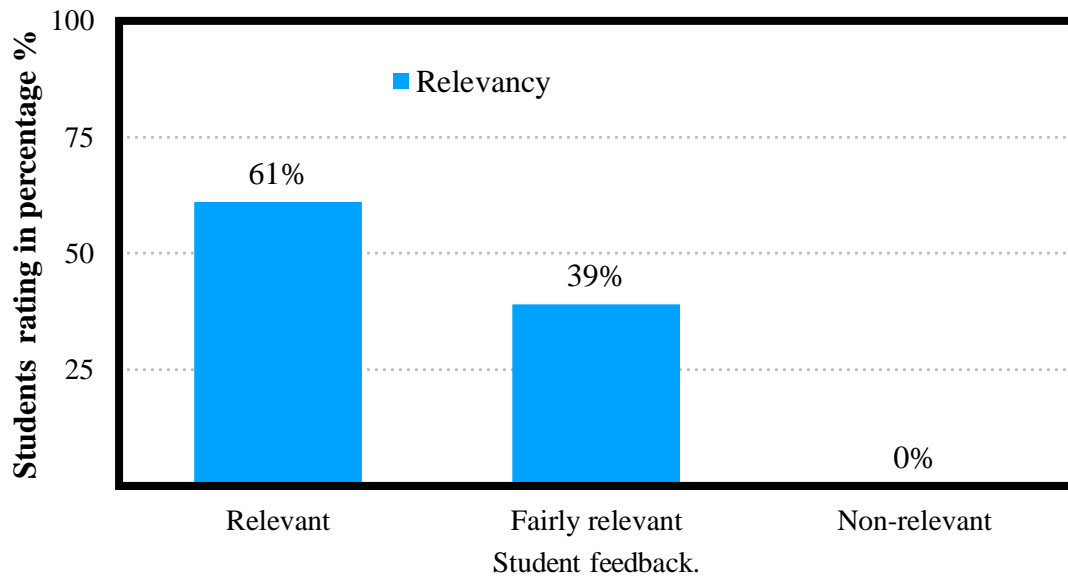


Figure 5.44 Bar chart source depicting the responses for the relevancy of field knowledge in identifying the different construction activities during post site visit.

Figure 5.44 showed the students responses for the relevancy of field knowledge gained during internship program to identify the different construction activities during site visit after the gap of three months. 71% students responded as satisfied, 29% responded as fairly satisfied for their reflectiveness of gained field knowledge for post internship program.

Table 5.22

Illustrates the students' feedback in agreeing for exposure and practical skills acquired through conducted project practicums.

To what extent do you agree that exposure and practical skills acquired through the internship program made you confident while choosing and working on classroom projects?		
Agree	Neutral	Disagree
82%	18%	0%

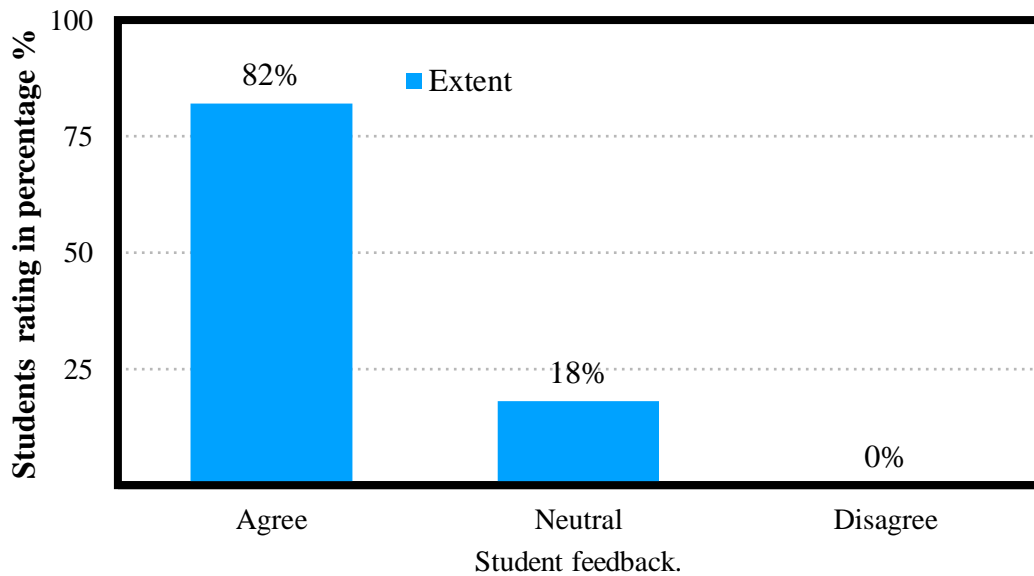


Figure 5.45 Bar chart depicting the responses for extent in agreeing that exposure and practical skills acquired through conducted project practicums.

Figure 5.45 showed the students response for the extent in agreeing in choosing and working on classroom projects after the exposure and practical skills acquired through internship program. 82 % students agree, 18 % responded as neutral for confident in choosing and working on classroom projects post internship experience.

Table 5.23

Illustrates the feedback responses received for increase in confidence to compete for a range of job interviews in study area of interest.

Do you agree if internship program has increased the confidence to compete for a range of job interviews in the study area of interest?		
Agree	Neutral	Disagree
75%	25%	0%

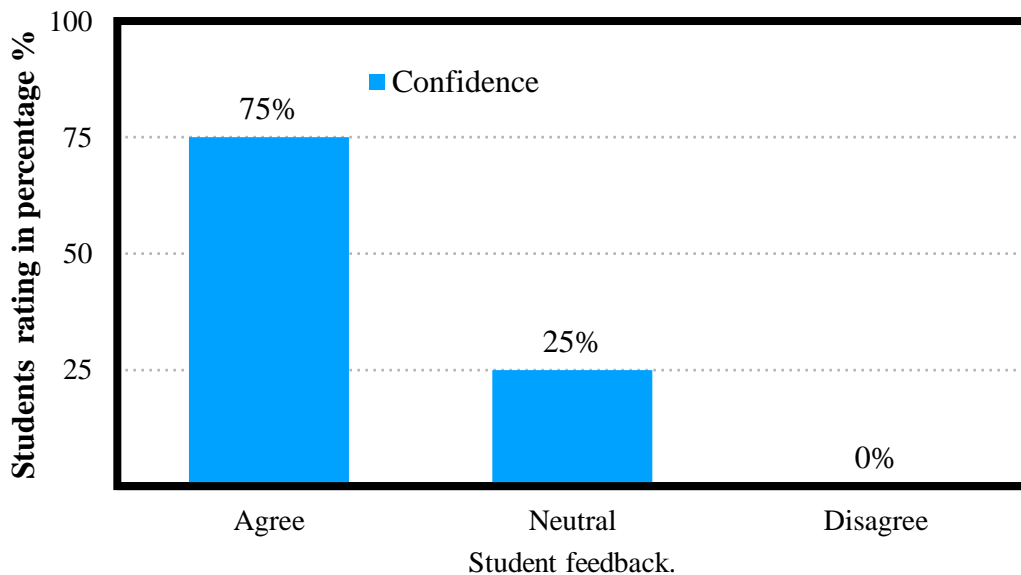


Figure 5.46 Bar chart depicting the responses for the increase in confidence in study area of interest during post site visit gained during conducting project practicums.

Figure 5.46 showed the students response for the increase in confidence to compete for a range of job interviews in study area of interest. 75 % students agreed, 25% responded as neutral for increase in confidence for job interviews in study areas

Table 5.24

Illustrates the feedback received for relevancy of experience gained to post site visit.

How much relevancy you felt of experience gained while conducting project practicums of PBL based internship experience to post site visit?		
Relevant	Fairly relevant	Non-relevant
63%	37%	0%

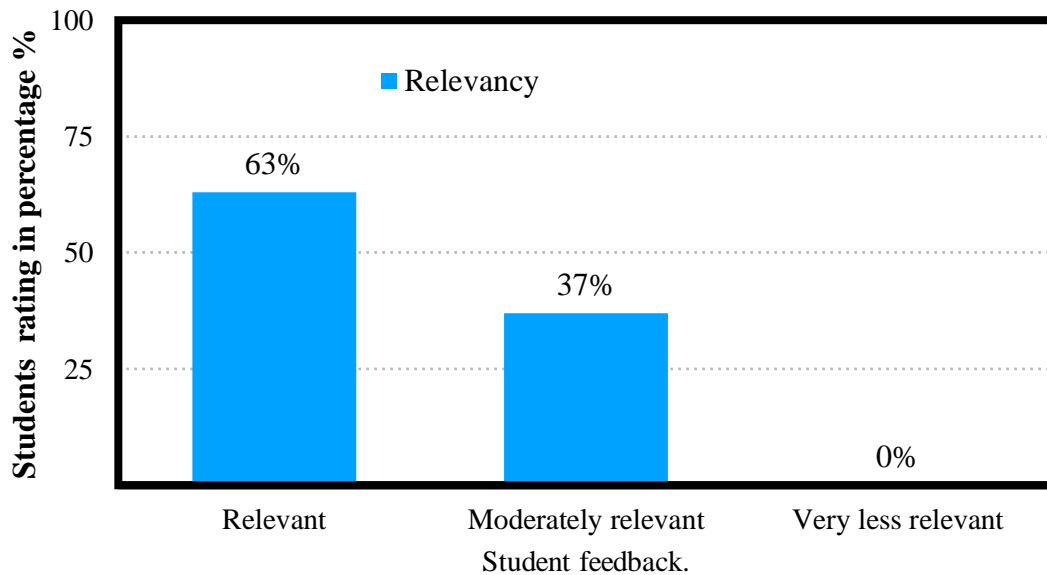


Figure 5.47 Bar chart depicting the responses for relevancy of experience gained while conducting post site visit.

Figure 5.47 showed the students response for relevancy of internship experience to post site visit after a gap of three months. 63 % students responded as relevant, 37%

responded as moderately relevant for relevancy to post site visit of conducted internship program practicum.

5.3 Discussion on interpretation of data.

PBL is the instruction where learners gain the knowledge of complex and multifaceted content of a subject matter by relating it with realistic world problems. PBL facilitates in learning through inquiry, working collaboratively, problem solving and enhancing communication.

Internship is the element for startling clarity, vision of their academic information in their professional careers. It binds the learners, educators, employers, industries to the required standards, requirements and demands of the job market and economies. Internship is a temporary–work placement or field training opportunity to gain experience work and experience field activities. In perspective of engineering, it is seen as an effective platform for engineering students to come in and have experience about the corporate world. Internship is becoming increasingly popular as an essential pedagogy for undergraduate education. An engineering Internship is an opportunity to apply theoretical concepts from the classroom to the realities of the field. Internships are to understand how classroom and textbook learning applies to field activities by identifying, formulating, analyzing, and solving engineering problems.

PBL presents on opportunity to reintroduce the breadth into engineering curriculum by participation in real projects as practical implementation of knowledge-based education approach. Project based Learning is an important pedagogical tool of the engineering education. By empowering students to learn outside of classroom lectures and developing contextual situations in which they can apply content and knowledge in the field practicum. Thus, incorporating of Project Based Learning as internship programs in the Civil engineering curriculum provided advantages and supports the learners and educators. As supported by theory of Constructionism, learners can expand beyond a knowledge point concentration by actively construct or build the knowledge.

The present study focused on the developing and implementing PBL internship curriculum for third year civil engineering undergraduate students. The PBL internship curriculum has field Practicums which were developed as per civil engineering course topics of third year civil engineering undergraduate program. The curriculum topics selected for the internship program were per the technical competence /course work knowledge attained by students till third year of civil engineering undergraduate program by learning professional core civil engineering courses of developed AICTE's curriculum. Students had acquired the theoretical knowledge and improved, hone it while conducting field practicums for respective courses at the construction site during PBL based Internship program.

Researcher conducted the achievement tests before and after the PBL - Internship implementation program. The mean achievement scores of pre-tests and post-tests of students were compared to measure the gain in field knowledge or improvement in technical competence. The mean achievement scores of delayed post-tests measure the retention of gained field knowledge by the students. The students' improvement in soft skills was investigated by the researcher by grading and reviewing the daily reports, individual weekly reports, final project reports and project presentations submitted by the students. The field supervisor feedback was collected in the form of supervisor evaluation forms which rates the students field knowledge from beginning to end of internship. Student provided the feedback for their experience in gaining field knowledge or finding any improvement in technical competence and soft skills was also collected in the form of student feedback form. Students reflect their classroom theoretical knowledge in the field and improved it by experiencing and working with site supervisors in construction scenarios. The students had worked collaboratively and co-operatively together as team members in the assigned groups by observing, monitoring and discussing with field site supervisors for queries which contributes in development and improvement in teamwork skills.

Students prepared and submitted daily reports as a team and weekly reports individually for conducted project practices of PBL based internship program, which contributed to improving technical writing skills of the students. Class

discussions, project reports and presentations submitted for conducted project practicums had contributed to improving technical writing skills in clarity, content organization, deliverance of material along with boosting confidence in students.

The feedback from the field supervisor had revealed the growth in the level of technical competence and skills in the students at the end of program was significant as compared to the knowledge and skill level at the beginning of the PBL based Internship program. The students had observed, monitored, and interacted with site supervisors for queries and distribute a fair share of work as a team. The student evaluation and feedback form responses indicated the significant increase in field knowledge and development in like decision making, problem solving, time management and communication skills.

The difference in mean achievement scores and calculated t value of pre-test and post-test achievement tests revealed the significant gain in the field knowledge or technical competence for the program participants. The mean achievement scores of delayed post-tests compared with mean achievement scores of pre-tests and post-test revealed the retention in the gained field knowledge. Students worked collaboratively as a team, were responsible for conducting field practicums, interacted and assisted site supervisors, prepared daily, weekly and final project reports and delivered presentations which had contributed in developing teamwork, time management, problem solving and communication skills while conducting project practicums for developed curriculum of PBL based internship program.

5.4 Findings of the Study:

The findings of the present study are presented from the quantitative analysis done for the mean achievement scores of students for conducted pre-test and post-test. The difference in the mean average scores of pre-tests and post-test evident towards gaining the field knowledge or improvement in the technical competence in students. The students' scores of delayed post-tests conducted after period of three months from conducted internship revealed the retention of gained field knowledge. Researcher's observations during project practicums implementation, student and supervisor's evaluation/feedback forms revealed the improvement in teamwork

skills while having interactions and communications among team members and site supervisors.

The students' improvement in soft skills was investigated by the researcher by grading and reviewing the daily reports, individual weekly reports, final project reports and project presentations submitted by the students. The field supervisor feedback was collected in the form of supervisor evaluation forms which rated the students field knowledge from beginning to end of internship.

Student provided the feedback for their experience in gaining field knowledge or finding any improvement in technical competence and soft skills was also collected in the form of student feedback form.

PBL based Internship program site supervisors revealed that they had observed the improvement in technical competence or field knowledge and development in the decision making, problem solving and communication. Students provided the feedback for their experience in gaining field knowledge or finding any improvement in technical competence and soft skills was also collected in the form of student feedback form.

The mean achievement scores of delayed post-tests conducted after the gap of three months from implemented project practicums of PBL based internship program were compared with pre-test and post-test mean scores which showed the retention of gained field knowledge. Delayed or post site questionnaire's performance indicated the students' reflectiveness and retention of gained field knowledge during post site visits after the gap of three months from conducted PBL based internship program.

The literature related reviewed studies had also shown the similar improvements as are shown in present study in the field knowledge or technical competence and in the soft skills. The findings of the Musthak Ahmed Syed, G. Madhuri, Reddy M.Sampath, Condoor Sridhar S. (2018) revealed that the PBL pedagogy provides the opportunity to students to work collaboratively in the groups, share their knowledge, develop and improve teamwork, problem solving, communication and other skills. The findings of the present study also matched with Alves Anabela C., Leão Celina P., Moreira Francisco and Teixeira Senhorinha (2017) where students

expressed the development and improvement in teamwork, time management skills and technical writing and oral skills.

Studies conducted by Mioduser David, Betzer Nadav (2007), Kartika Arum Sari, Zuhdan Kun Prasetyo, and Widodo Setiyo Wibowo (2017) results showed PBL pedagogy contribution in bringing positive attitude and improvement in learners problem solving abilities, collaboration and communication skills which matched with the findings of the present study.

The findings of the Musthak Ahmed Syed, G. Madhuri, Reddy M. Sampath, Condoor Sridhar S. (2018) revealed that the PBL pedagogy provides the opportunity to students to work collaboratively in the groups, share their knowledge, develop and improve teamwork, problem solving, communication and other skills. The findings of the present study also matched with Alves Anabela C., Leão Celina P., Moreira Francisco and Teixeira Senhorinha (2017) where students expressed the development and improvement in teamwork, time management skills and technical writing and oral skills.

The findings of the study by Bee croft, Pauline C., FAAN; Kunzman, Lucy MS; Krozek, Charles MN. (2001) investigated the benefits of Internship program matched with the findings of present study. The analysis shows that internship program participants were more professionally skilled and confident.

The findings of the study by Lam Terry, Ching Larry, (2007) as discussed in literature review, investigated the satisfaction level and the expectations of the participant students towards the conducted internship program. The findings of the study revealed comparable results to the present study results. The analysis of the student feedback questionnaire for the present study revealed that the students felt that the team spirit, involvement, guidance and help from supervisors had motivated them during internship hours.

The tools of data collection were carefully designed to relevantly collect the data of the present study from all possible verticals for purpose of triangulation of collected data as recognized by studies discussed in literature review. The study by Beard Deborah F. (2007) suggested and supported on tools of data collection like daily report, project reports and presentations, student evaluation forms which

matched with the data collection tools of the present study. The author recognized the assessment tools used to evaluate the internship experience, student learning and satisfaction with the internship program had provided the important insights from the perspective of the student interns and external internship supervisor.

The findings of the study by Pee, S.H. and Leong, Helene (2005), Hashim, Roslan, Azizi Mohd Din, Mokhtar (2009) conducted the study by implementing PBL in various ways and identified PBL's contribution in learning and development of soft skills. Studies results matched with present study as students had appreciated the curriculum structure where they can interact with industry experts and work on real world problems. Engineering course with PBL pedagogy had proved effective as shown improvement in skill development, soft skills, critical thinking, problem solving and creativity among students.

Studies conducted by Lee, Peiyu (2010) Yam, Lee Hong Sharon and Rossini, Peter (2010), Mergendoller John R., Maxwell, Nan L., Bellisimo, Yolanda (2006) pointed out the positive impact of introducing PBL with different courses and the results showed PBL program participants learned to work effectively with multidisciplinary teams, taking responsibilities, to be accountable for decisions taken and their usefulness and applicability in professional environment. The results of these studies coincide with the present study's results of development in teamwork, decision making, problem solving and communication skills.

Studies conducted by Anabela C. Alves, Celina P. Leão, Francisco Moreira, Senhorinha Teixeira (2016 - 2017) Dole, Sharon., Bloom, Lisa., and Doss, Kristy K., Levitt, S., McKeage, A., and Rangachari, P. K. (2013) findings revealed that Project based learning in different areas provided similar benefits as of present study such as developing timelines and present problem / project outcomes in every stage of the learning process which helped the students in career opportunities.

In conclusion it can be said that the present study of implementing PBL based internship program's curriculum at undergraduate civil engineering level was found effective.