Development of communication competency for civil engineering students

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Abstract. This study is specifically aimed at: (i) assessing the communication competencies of engineering students; (ii) identifying important communication skills needed for engineering students; and (iii) ensuring the types of effective teaching and learning activities to develop communication skills of engineering students. The implementation of the study refers to this quantitative-descriptive approach presenting a survey which includes the main activities, namely literature study, primary data collection and analyse, conclusions and recommendations formulation. Analysis is carried out based on information obtained from respondents. Furthermore, data processing is done by using descriptive methods that provide simple and understandable data presentation for the reader by describing or giving information about a data or situation or phenomenon. The survey findings indicate the adequacy of communication training from a curriculum that integrates communication in various core civil engineering courses. The results of the study also showed that team work and oral presentations were the most important factors for civil engineering students and for their future career development. They also place the greatest emphasis on teaching and learning activities that aim to prepare them to take part in the industrial world later.

1. Introduction
Communication skills are an essential component in education of engineering students to facilitate not just students’ education but also to prepare them for their future careers [1].

1.1. What
A review on employability skill needs in engineering shows that communication skills have appeared in all 23 lists of employability skills (required of graduates) produced [2], in consultation with employers, by various recruitment organizations between 1998 and 2005.

1.2. Why
In the survey from 109 engineering-related employers in Australia [3], find that the top three graduate attributes with greatest competency gaps (i.e., difference between the reality and employers’ expectation) are: oral communication skills, interpersonal skills with colleagues and clients, and written communication skills. This finding is similar to previous industrial recruitment surveys, indicating that engineering graduates lacked communication skills required by employers [4–6].
1.3. Purpose
The need to harmonize the development of civil engineering curriculum with industry needs, by looking at how engineering graduates feel their readiness, in terms of their communication competencies to work

2. Methods

2.1. Methodology
The implementation of the study refers to quantitative methods. This research uses survey type research design. Survey research is relatively fast and efficient for (a) obtaining information from targeted samples, and (b) generalizing research findings based on the sample involved.

2.2. Sample
The object of this research is Civil Engineering students, Faculty of Engineering, in all universities in Indonesia. By looking at the sampling unit (respondents) can be accessed, easily measured and are usually very helpful and willing to cooperate, as well as in focused groups, then the sample determination applies convenience sampling techniques.

2.3. Questionnaire design
The questionnaire was carefully designed to meet the research needs. Questions will be taken from the previous literature review on communication competencies with a view to validate research questions that cover a diversity of research problems. The questionnaire consists of four main parts, which are:

- The first part - oral presentations and public speaking.
- The second part - teamwork and interpersonal interaction.
- The third part - the use of electronic equipment in communication.
- The fourth part - technical writing,
- The fifth part - knowledge, understanding and technical skills.

2.4. Formula
In addition to descriptive statistics, one sample t-test will also be conducted to test the significance of students' self-perceptions about readiness for communication skills. The average value of the sample is compared with the known value. Here, test value = 4 (neutral score) is used to evaluate student perceptions. If statistically the average score is greater than 4 means they are quite ready, but if the average score is less or equal to 4, they are less prepared for each communication skill. A simple average value, provides an objective measure in identifying communication skills that require immediate attention to overcome weaknesses in communication training. Furthermore, in assessing respondents’ perceptions of the importance of communication skills for entry level graduate positions and job promotions, importance index is calculated for each category using the following formula importance index

\[ \text{Importance index} = \frac{7.n7 + 6.n6 + 5.n5 + 4.n4 + 3.n3 + 2.n2 + 1.n1}{7N} \]

With n7 is the number of respondents who answered "very important" (7), until n1 the number of respondents who answered "absolutely not important" (1) and N total number of respondents. This index helps in ranking skill categories according to their interests, and also determines the similarity or difference between the position of beginner level graduates and promotion.

3. Results
A total of 284 students responded to the survey addressed to them. Characteristics of respondents are consisting of 170 men (59.9%) and 114 women (40.1%). They are enrolled at the Faculty of Engineering, Department of Civil Engineering, from various universities in Indonesia, as seen on Figure 1.
In this study there are 3 factors that will be analysed related to communication competency for civil engineering students, namely:

- Communication Readiness Variables
- Communication Skills Variable
- Effectiveness of Learning and Teaching Variable

3.1. Communication readiness variables
Respondent's self-perception test for communication readiness using one sample t-test with 4 test scores (neutral score), consisting of 21 indicators as shown in Figure 2.

From the test results can be seen the average score of readiness for communication skills, statistically greater than 4. That is, there is adequate preparation in each communication skill. The item "appreciates the importance of cooperation and tolerance in the work team environment" has the highest score (6.28). The second position was occupied by the item "Ability to work as part of a team" with a score of 5.89. The third highest score item is "Understanding the use of visual aids (eg diagrams, photos) for effective oral presentations" and "The ability to communicate with people with different backgrounds, experiences, and cultures" 5.67.

3.2. Communication skills variable
An important index of the eight main communication skills categories for entry level graduate positions and job promotion can be seen in Figure 3.

It can be seen that the top three skill categories for entry level graduate and job promotion positions are the same, namely (i) teamwork skills; (ii) public speaking skills; and (iii) technical knowledge and skills. However, teamwork and public speaking skills are considered the most valuable in work promotion as well as important communication skills.
3.3. Effectiveness of learning and teaching variable

When respondents were asked to assess the effectiveness of eleven teaching and learning activities to develop the communication skills of civil engineering students, then all activities averaged over 4 as shown in Figure 4. The graph in Figure 4 shows that respondents placed the greatest emphasis on two teaching-learning activities that aim to prepare students for industry-related experience (i.e., project communication management, average = 5.6452) and to gain experience in group collaboration arrangements (i.e., organizing small discussion groups, mean = 5.7097). These two activities are followed by teaching and learning activities that relate to the skill of making reports, namely the writing of technical reports; and place greater emphasis on oral presentations. The importance of teaching and learning activities is more highlighted in their recommendations in open feedback questions.
Figure 4. Effectiveness of learning and teaching.

4. Discussion
Overall, the survey findings show that respondents were satisfied with the communication training in the civil engineering program, which was adequately prepared them for job requirements after graduation [7]. Respondents agreed on the importance of the same three communication skills for the feasibility and progress of students as prospective civil engineering graduates and success in industry [8]. These three skills are, (1) interpersonal communication skills, (2) teamwork skills, and (3) technical knowledge and skills. All three greatly influence the employability of civil engineering graduates and their progress and success in the industry.

Of course all three skills must interact collaboratively to create effective communication [9]. The ability to communicate effectively is a very basic skill and must always be developed, so that it can develop trust and empathy for the communicator (Team FME 2013). The importance of this skill is in line with Sutherland who found a significant relationship between the three communication competency factors with trust [10]. Trust is recognized as an important component of effective leadership. One way to build trust is through experience in communication transactions between individuals.

In other words, only through communication competencies can people from various backgrounds communicate effectively and successfully. Therefore, communication competencies become a very powerful ability for students to adjust to environmental, social, and cultural conditions at work, after graduation.

5. Conclusion
Respondents were generally satisfied with communication training in civil engineering programs which was enough to prepare them to work in the workplace after graduation.

Teamwork and oral presentations are communication skills that greatly influence the feasibility of fresh graduated civil engineering and its progress and success in the industry.

In the teaching and learning process, respondents emphasize the teaching and learning process which aims to prepare students in industry-related experiences, namely, making technical reports and oral presentations. In addition, to gain experience in group collaboration arrangements, small discussion group arrangements are needed.

References
[1] Riemer M J 2007 Communication Skills for the 21st Century Engineer Glob. J. Eng. Educ. 11 89–100
[2] Markes I, Maddocks A, Bamforth S and Crawford A 2004 UK SPEC and the RAPID Progress File: A Tool for Academic, Personal and Professional Development in Engineering
International Conference on Engineering Education (Florida)

[3] Nair C S, Patil A and Mertova P 2009 Re-engineering graduate skills—a case study Eur. J. Eng. Educ. 34 131–9

[4] Lang J D, Cruse S, Mcvey F D and Memasters J 1999 Industry Expectations of New Engineers: A Survey to Assist Curriculum Designers J. Eng. Educ. 88 43–51

[5] Meier R L, Williams M R and Humphreys M A 2000 Refocusing our efforts: Assessing non-technical competency gaps J. Eng. Educ. 89 377–85

[6] Scott G and Yates K W 2002 Using successful graduates to improve the quality of undergraduate engineering programmes Eur. J. Eng. Educ. 27 363–78

[7] Khoreshok A A, Zhironkin S A, Tyulenev M A, Barysheva G A, Blumenstein V Y, Hellmer M C and Potyagailov S V. 2016 Innovative Technics of Managing Engineers’ Global Competencies Materials Science and Engineering p 142

[8] Balboni P E and Caon F 2014 A Performance-oriented Model of Intercultural Communicative Competence J. Intercult. Commun. 35 1–12

[9] Muszynska K 2015 Communication management in project teams—practices and patterns Technology, Innovation and Industrial Management

[10] Sutherland I E 2011 Communication Competence and Trust In Leaders: From Transactional, Through Transitional, to Transformational Exchanges, Dissertation. (Lehigh University)