

# **A SURVEY OF THE PROGRESS OF STUDENTS' GENERIC SKILLS**

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## **ABSTRACT**

At the National Institute of Technology, Sendai College, we are continuously examining the generic skills (GSs) of students using PROG, an objective assessment test. We report the results of the GS growth characteristics of college students from their admission to graduation. We will introduce how we use the results of the survey for the students and faculty members, both those that are currently being implemented and those that will be implemented in the future. The feedback of the results of the surveys makes it possible to quantitatively evaluate the growth of the students' GSs, which is difficult for students to recognize and to foster efficiently by themselves. Besides, the feedback of these survey results can quantitatively evaluate the students' GS training, which is difficult for teachers to evaluate accurately and train efficiently. Therefore, the efficiency and quality of our college education can be improved.

## **KEYWORDS**

Generic Skills (GSs), evaluation of GSs, Progress Report on generic skill (PROG), Utilizations of PROG results, Standards 11, 12

## **BACKGROUND**

A National Institute of Technology in Japan is a five-year higher education institution that provides engineering education to foster engineers with practical skills and expertise. At the National Institute of Technology, Sendai College, we are conscious of the significance of developing human resources that meet the needs of society and improving our education in accordance with the three policies (admission policy, curriculum policy, and diploma policy). In particular, we implemented the reorganization of departments and the introduction of a course system.

In engineering education, in addition to the acquisition of knowledge and skills, it is important to develop skills, called generic skills (GSs), to utilize the acquired knowledge and skills in the real world. However, it is difficult to evaluate GSs, which include intention and behavioral characteristics, by the conventional test, which is supposed to confirm the learned knowledge. Furthermore, it is very difficult to evaluate the GSs accurately using the rubric-based evaluation method, because the students' self-evaluation, the mutual evaluation between students, and the evaluation by teachers may differ.

At Sendai College, we have been conducting continuous surveys of the students' GSs using an objective method, which started in 2014 and was conducted annually until 2018. It allows us to follow of the same students for five years from their admission to graduation. Therefore, it will clarify the students' GS growth characteristics in 5 years at Sendai College. In this paper, we first outline the standardised tests used for GS evaluation. Next, we report the GS growth characteristics of our students, as clarified by the survey. Finally, as a way to make use of the results of the GS survey, we introduce how we give the students and teachers feedback and what we plan to implement in the future for the students and teachers.

## **GS EVALUATION METHOD**

As a method of evaluating GSs, there are direct evaluations by students and teachers using rubrics and indirect evaluations by external standardised tests. In our survey, we used PROG (Progress Report on Generic Skills), one of the standardised tests in Japan (Kawaijuku Group, 2019). PROG, which is an objective evaluation, has the following advantages: 1) Evaluator's subjectiveness is not included; 2) Comparative analysis with the average of examinees (university students, etc.) other than our college can be performed.

PROG consists of two parts: a literacy part that evaluates the examinee's practical ability to solve problems using their knowledge, and a competency part that evaluates the examinee's ability to build good relationships with the surrounding environment. The evaluation items for the PROG test are determined based on the key competencies in the OECD's DeSeCo project (OCED, 2019) and the surveys on the skills required by Japanese companies. They are classified into six items for the literacy part and three items for the competency part. The competency part has three major categories, and each major category has nine middle categories and 33 elements as minor categories. Table 1 shows the PROG evaluation items. As shown in Table 1, many of the elements of the PROG evaluation correspond to those described in the CDIO syllabus2.0 (CDIO, 2019). In particular, Teamwork skills and Personal skills of PROG (major categories of competency) are equivalent to Interpersonal skills: teamwork and communication and Personal and Professional skills and attributes in the syllabus, respectively. Many presentations on the development of these skills have been made at the 15<sup>th</sup> International CDIO Conference, and the development of generic skills is now one of the important topics.

The literacy part consists of questions such as numerical reasoning and text comprehension. On the other hand, in the competency part, there are many questionnaire-type questions for examining behavioral characteristics. For example, to a question, "When talking with a person you are new to, how do you act?" the answer should be a five-grade evaluation from "Very friendly to very politely." The evaluation of each component of the competency part is quantified by comparing the statistically processed exemplary answers of 4,000 Japanese businesspersons who were rated as "excellent." PROG test scores are rated either from 1 to 5 or from 1 to 7, depending on factors, in both literacy and competency parts, with larger numbers indicating better results.

In the 2018 test, about 110,000 university and college students took the literacy part, and about 530,000 university and college students took the competency part, the total number of universities and college students in 2018 is about 3 million. Therefore, a statistical comparison of GSs between our students and university students is possible. In this paper, we compared our students' average score of PROG with the score of university students who took the same test to confirm the educational effects.

## GS SURVEY RESULTS

Figure 1 shows the Generic Skill Growth Characteristics of Students of National Institute of Technology, Sendai College, Hirose Campus, and table 2 shows the PROG testees' grades each year. Five years have passed since the GS survey started, and the continuous survey from the first year of admission, 2014, was completed in 2018. Therefore, this survey will clarify

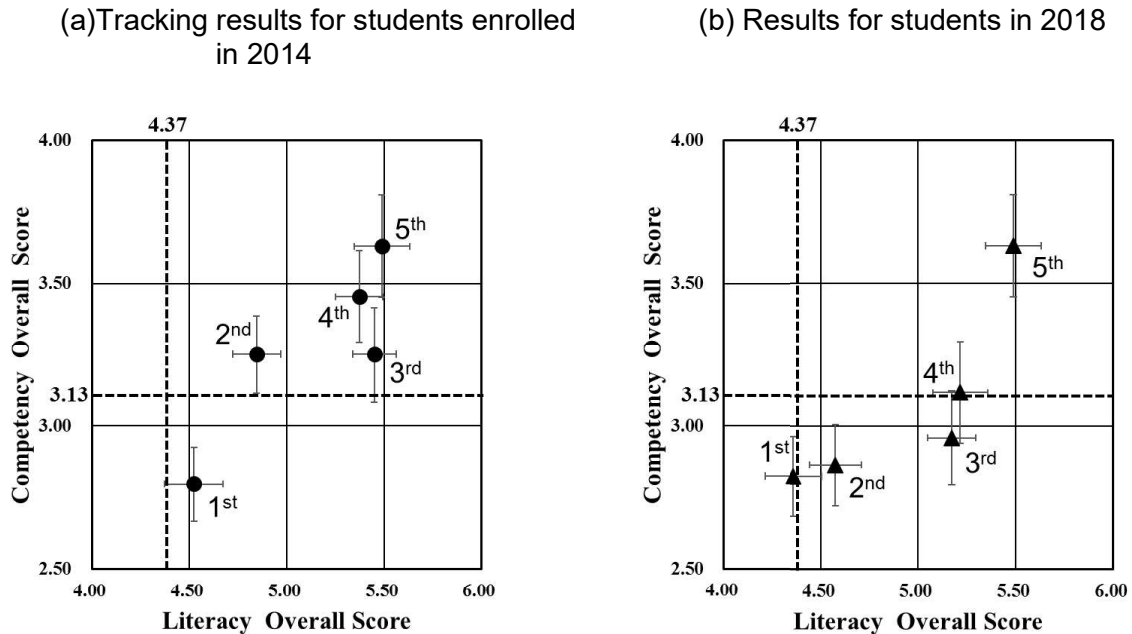


Figure 1. Generic Skill Growth Characteristics of Students of National Institute of Technology, Sendai College, Hirose Campus

How the students' GSs change with the progress of the college year in the education course at Sendai College, Hirose Campus.

Figure 1(a) shows the GS growth characteristics of the group of the same students from the first year (2014) to the fifth year (2018). Figure 1 indicates that both the students' literacy and competency grew steadily as their grade advanced. On the other hand, the dotted line in the figure represents the average value of university students who took the same test in 2018 (literacy: 4.37, competency: 3.13). The average of our college first-grade students' literacy scores exceeds that of university students,' and the second-grade students' competency scores exceed that of university students.' However, it can be seen that their competency score did not increase between the second and third grades, and the literacy score did not increase between the third and fourth grades.

Table 1. PROG evaluation items

**Evaluation elements of literacy part**

Literacy	Collecting information
	Analysing information
	Identifying problems
	Forming strategies
	Linguistic Processing Skills
	Nonlinguistic Processing Skills

**Evaluation elements of Competency part**

	main (3) categories	medium (9) contents	small (33) components
Competency	Teamwork skills	Relating with others	Approachability
			Attentiveness
			Interpersonal interest/Empathy/Receptiveness
			Diversity understanding
			Building up a network of connections
		Trust building	
		Cooperating with others	Role understanding / cooperative action
			Information sharing
			Mutual support
	Consultation / guidance / motivating others		
	Team management	Talk to each other	
		Express opinions	
		Constructive/Creative discussion	
		Opinion coordination, negotiation, persuasion	
	Personal skills	Self control	Self-awareness
			Stress coping
			Stress management
		Self confidence	Understanding of identity
			Self-efficacy / optimism
			Personal Transformation by learning view/opportunities
	Behavior control	Subjective action	
Outworking			
Getting into the habit of positive actions			
Problem solving skills	Problem identification	Information collection	
		Understanding of the essence	
		Cause investigation	
	Planning solutions	Goal setting	
		Scenario modeling	
		Plan assessment	
		Risk analysis	
	Implementing solutions	Practical action	
		Correction / adjustment	
Verification / improvement			

Table 2. Grades of PROG examinee

Grade	Academic Year				
	2014	2015	2016	2017	2018
1st	○	○	○	○	○
2nd	○	○	○	○	○
3rd	○	△	○	○	○
4th	○	○	○	○	○
5th	○	△	○	×	○

- : Students of every department took the PROG test
- △ : Only students of some departments took the PROG test
- × : Students did not take the PROG test

Figure 1 (b) shows the average literacy and competency scores of each grade in 2018. Both figures indicate that both literacy and competency scores grew as the college year advanced. In comparison with the average scores of university students, our first-grade students' average literacy scores and the fourth-grade students' competency scores respectively are equivalent to those of university students'. Since the fourth grade of the National Institute of Technology corresponds to the first grade of the university, the 2018 survey shows that the GSs of our students grow enough as the grade progresses. However, from the first grade to the third grade, literacy grew, and competence grew less. On the other hand, from the third grade to the fifth grade, the growth of competency is large, and the growth of literacy is small. Therefore, it can be said that literacy grows from the first grade to the third grade, and then competence grows after the third grade.

By a five-year follow-up survey of the same students (Fig. 1 (a)), a survey of five different grades of the same year (Fig. 1 (b)), and a comparison with the average value of university students, it turns out that both averages of literacy and competency of our students grow. However, a closer examination of the individual results of the PROG test revealed that in some grades, their literacy or competency did not grow enough. As the students' growth characteristics of GS have been clarified, we will analyze relations between the content and methods of education and their GS growth characteristics to improve our college curriculum.

## HOW TO USE GS CONTINUOUS SURVEY

The basic principle of using PROG results in our college is to make our students aware of their generic skills level and use them as a basis for their own steady growth. For that reason, we do not set a minimum score for PROG results and do not provide special guidance to students who do not achieve that score. The following describes how to use the current PROG results and plans to use it in the future.

We have been conducting continuous surveys on students' GS since 2014. In this section, we explain how we use the survey results. First, we explain how our students use the survey results. We are currently implementing two uses. The first use is "Strength Sheets and Reinforcement Books (Handbook for fostering GSs and Explanation for GSs)" for the first and second graders. Since PROG is a test mainly for college students and above, some of our students in grades 1-3 may get lower scores. Some students will think that their GSs are not good enough. Therefore, by distributing a "strength sheet," which summarizes only one's strengths and the GS score results, and by homeroom teacher's explanation of the result focusing on the student strengths, they can recognize their own strengths and weaknesses without losing confidence. Moreover, we can then try to empower the necessary GSs using the reinforcement book.

The second use is to hold a result report briefing session for upper grades (3rd to 4th graders) by the specialist of the PROG development company. Grades 3-4 are the grades just before students start job hunting and corporate internship. They are required to have an accurate self-analysis when making entry sheets for job hunting and corporate internship, but many students are not good at conducting an accurate self-analysis. Students can clarify their appealing points by comparing their PROG scores to the average scores, and by looking at the growth of their scores from a follow-up survey and considering what experience has resulted in the growth.

Next, we will explain "GS portfolio creation," which is scheduled to be implemented from 2020, and "Student's voluntary GS growth cycle." Students will make a GS portfolio that records the results of the PROG exam in addition to the regular academic portfolio. In the GS Portfolio, by recording the score of the PROG evaluation item and visualizing it in a graph, the students can easily recognize their GS growth, which is difficult for students to recognize by themselves. In addition, it would be useful for them to be able to recognize their strengths and weaknesses clearly by comparing their GS scores to the average of their classmates and university students. In the GS Portfolio, they set their own one-year goals of GS growth at the beginning of the academic year and then do self-evaluation at the end of the academic year, as shown in Figure 2. Students spend a year with "strengthening their strengths" and "improving their weaknesses" in mind, based on their goals, which are the ones they want to achieve. Living in that way is expected to foster a more effective and efficient GS than living, not paying attention to them. By continuing to live like that for one year, re-recognition of PROG exams, growth, and resetting of goals in the next year, they will spontaneously improve their lives, and as a result, they will be able to realize a spontaneous and effective GS growth cycle.

### 1-year effective Generic Skills growth cycle

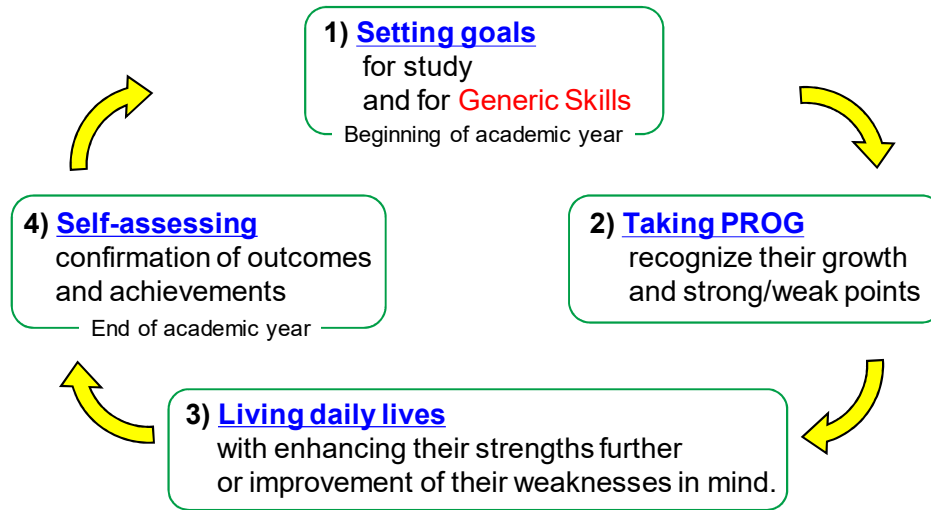


Figure 2. GS growth cycle of students

Next, we explain how teachers make use of it. From the beginning of the survey, the person in charge of the PROG development held a briefing session on how to analyze the results (Figure. 3) and the GS trends of each class. In the briefing session, teachers will be explained the strengths and weaknesses of the class in terms of their GSs and will be given notes on class management and suggestions for improvements. With these explanations, homeroom teachers and other teachers teaching different subjects can learn the helpful features of the class that cannot be measured with conventional examinations.

In addition, the teachers in charge of senior students (grades 4-5) use the results of PROG to support students' careers. PROG developers have published a survey on the relationship between PROG scores and the students employed by companies (PROG Hakusho2018, 2018). Based on the results of this survey, teachers were able to give appropriate advice such as what kinds of GSs they would need to work for the company or industry they wanted to enter. For students, it also has the advantage of making it easier to set GS goals.

### **MOVING FORWARD**

We are currently preparing to use the PROG results for class arrangement. We plan to organize classes not only based on grades but also based on GS characteristics of students from next year.

Finally, a follow-up survey revealed GS growth trends from admission to graduation. In other words, we think that we can analyze the educational effects on students' GSs in terms of the curriculum, such as what element grew in each grade. While it is difficult for teachers to evaluate the students' GSs accurately, using the PROG to quantify their GSs objectively has made it possible to measure the educational effect accurately without a large burden. In the



Figure 3. GS feature analysis briefing session for teachers

future, we plan to improve the class and curriculum for GSs by analyzing the educational methods and curriculum contents used in each class and the GS growth of students in detail. We also plan to develop a diploma supplement for GSs.

## CONCLUSION

At the National Institute of Technology, Sendai College, we have been continuously examining the generic skills of students using PROG, an objective evaluation, since 2014. A five-year continuous survey has revealed the generic skills growth characteristics of students from their admission to graduation. The follow-up survey showed that both students' literacy and competency grew as their grades in college advanced. On the other hand, it has also revealed that there are some grades in which students' literacy or competency did not grow much.

As feedback from the continuous survey, we distribute "strength sheets" to students and hold "result utilization briefings." In the future, we will try to practice the spontaneous growth cycle of students using the "generic skill portfolio". On the other hand, as feedback to teachers, we hold the "result report briefing session" to manage the class and to utilize it for students' career support. We will use it for class management from next year. We are currently conducting a detailed analysis of the curriculum, lesson contents, and the results of the PROG to improve the curriculum and lessons. Based on these results, we will develop diploma supplements for GSs and improve the quality of lessons.



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## **REFERENCES**

- Kawaijuku Group (2019). About Progress Report on Generic Skills (in Japanese):  
<https://www.kawaijuku.jp/jp/research/prog/>
- OECD (2019). About DeSeCo Project at OECD: <http://www.oecd.org/education/skills-beyond-school/definitionandselectionofcompetenciesdeseco.htm>
- CDIO (2019). About the CDIO Syllabus v2.0: <http://www.cdio.org/benefits-cdio/cdio-syllabus/cdio-syllabus-topical-form>
- PROG Hakusho2018 (2018). About survey on the relationship between PROG scores and the students employed by companies (in Japanese): Riasec Career Research Institute, Gakuji Syuppan

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