

Continuous Quality Improvement of Leadership Education Program Through PDCA Cycle

Tomoko Maruyama Ehime University, Ehime, Japan Masahiro Inoue Shibaura Institute of Technology, Saitama, Japan

The reinforcement of quality assurance system in university education is in great demand. With the goal of quality assurance of a class curriculum, the plan-do-check-act (PDCA) cycle was applied on leadership education on graduate students of engineering, resulting in seven years of continuously improved quality of the education program in which students achieved their learning goals. At the end of the course, the authors analyzed the gap between the target and the progress made to date and reflected the next course design with the evaluation results for improvement. The traditional leadership education only gave students knowledge regarding leadership in the form of lectures. Therefore, how to apply this knowledge through students' action has been a big issue for them. The leadership education program was introduced to improve leadership ability of students, which integrates knowledge, simulated experiences, and real actions. This leadership education program was conducted in the masters program at the Shibaura Institute of Technology's Graduate School of Engineering and Science between 2008 and 2013. The diagnostic, formative, and overall evaluations were made to measure the extent to which students achieved their goals. With evaluation results of clarified learning outcomes, a PDCA cycle was repeated in order to improve quality of the education program in three stages. This research concludes that this cycle led to the achievement to produce effective leadership actions of students.

Keywords: leadership education, quality improvement, plan-do-check-act (PDCA) cycle, course evaluation

Introduction

The importance of university education is being stressed and reinforcement of quality assurance system in education is in great demand. Higher education institutes of engineering are expected to facilitate information processing, knowledge of communication techniques, and project management as part of their fundamental education programs, as well as give students chances to execute teamwork and leadership as applied skills.

The traditional leadership education only gave students knowledge regarding leadership in the form of lectures. Therefore, how to apply this knowledge through students' action has been a big issue for them. Although a person could exert leadership of ideas through persuasive writings or making speeches, most

Tomoko Maruyama, Ph.D., assistant professor, Office for Educational Planning and Research, Ehime University, Ehime, Japan.

Masahiro Inoue, Ph.D., professor, College of Systems Engineering and Science, Shibaura Institute of Technology, Saitama, Japan. Correspondence concerning this article should be addressed to Tomoko Maruyama, 3 Bunkyo-cho, Matsuyama, Ehime

⁷⁹⁰⁻⁸⁵⁷⁷ Japan.

leadership happens in an interactive context between individuals and among group members (Komives, Lucas, & McMahon, 2013). The leadership education program was introduced to improve leadership ability of students, which integrated knowledge, simulated experiences (Aldrich, 2004), and real actions. Thus, a new leadership education program was created in order to enhance students' actions, which in turn led an improvement of the quality of the educational method.

This leadership education program was conducted in the Masters program at the Shibaura Institute of Technology's Graduate School of Engineering and Science between 2008 and 2013. The assessments were carried out to measure the extent to which students achieved their goals in the program. With evaluation results of clarified learning outcomes, a plan-do-check-act (PDCA) cycle is repeated in order to improve quality of the education program in three stages.

Few studies have been reported on a concrete method for improving of class curriculum through PDCA cycle. Mine (2014) proposed a new methodology for improvement of the social studies lesson, namely, spiral PDCA cycle. This spiral PDCA cycle consists of decision of lesson type by learning outcome at the first stage, PDCA cycle for the lesson according to each quality formation at the second stage, and PDCA cycle with which the lesson is improved by examining and then looking down upon the difference among the relativized view on the lesson, upon which the practitioner depends, and other views on the lesson at the third stage (Mine, 2014). Otsuka, Mizukoshi, Watanabe, and Yatsushiro (2015) have reported a system model to support the PDCA cycle as a whole and implement a system based on the model for a teaching and assessment support system. Ishii (2015) has reported learning records to make students discover subjects through a cooperative self-instruction based on the PDCA cycle in the PBL education.

The purpose of this paper is to report the continuous quality improvement of leadership education program through PDCA cycle (Dragan, 2003).

The PDCA Cycle to Assure Quality in Leadership Education

The PDCA cycle to assure and improve quality in education was created in order for students to achieve their set learning goals. The intention for this PDCA cycle is that students, by gaining leadership skills, can become engineers and execute their tasks at appropriate levels in the society.

P (Plan): Contents and Levels of Learning and Educational Achievement Goals

The contents and levels of learning and educational achievement goals were set.

- (1) Contents of learning and educational achievement goals:
- To understand systematic knowledge of human skills required in conducting project activities;
- To execute human skills and leadership in technical activities in science and engineering;
- To set action goals by reviewing their own human skills objectively.

(2) Levels of learning and educational achievement goals:

This leadership education has level 1 "knowledge", level 2 "consciousness", level 3 "action", and level 4 "mastery" (Table 1). In contrast, the traditional leadership education only provided level 1 "gaining knowledge" and had no curriculum designed to transform knowledge into action.

		Learning level		Goal content
7		Level 1	Know	Understand necessary knowledge to act leadership
		Level 2	Conceive	Realize needs of behavioral change and improvement point of daily action to reflect on oneself through the simulated experience
		Level 3	Act	Act as what he/she did in simulated experience, in the real situation
		Level 4	Master	Establish new routine by repeating the act

Table 1Leadership Educational Achievement Level

D (Do): Educational Method, Program Design for Goal Achievement

This leadership education is intended for students not only to gain traditional knowledge, but also to facilitate them applying the gained knowledge. The intent is also to enhance the transformation of their actions into solidly embedded leadership qualities. Therefore, the traditional lecture-centered education method was required to shift quality-wise. Palmer (1998) used the phrase "head, heart, and practice" to describe the paradoxes in teaching and what happens when people keep the head (knowing and intellect) separated from the heart (being) and even further separated from practice (doing). Palmer (1998) argued that people need a synthesis of all three components in the teaching process. The same applies in the leadership process.

To realize this quality shift, the following education method and program design were cornerstones:

(1) Utilization of simulation for transformation of action:

In order to enhance transformation of action, it utilizes simulation, which is a training tool providing repetitive practices and simulated experiences. A student can be less resistant to being a leader following repeated practices of leadership actions in a simulation. Hence, the simulation is the bridge between knowledge and realization. Also, with continuous repeated practices, a student gets accustomed to act in a new way.

(2) Leadership education program design:

A program was designed for students to have consciousness, actions, and mastery through a continuous cycle combined with knowledge, simulated experiences, and application in reality. Also, using diagnostic, formative, and overall evaluations, the authors measured the degree of achievements of students' study goals, and visualized students' achievements. Moreover, this design promotes active leadership actions outside of a seminar room: whether in home or school (Figure 1).

C (Check): Evaluation Method to Assess Goal Achievement

The authors checked whether students achieved their learning goals, systematically combining 360-degree assessments, rubrics, learning portfolios, student achievement interviews, and their emotional intelligence quotients.

A (Act): Improvement of Overall Education Program Based on Assessment Results

Using evaluation results, the authors monitored where students did not reach their initial target values. For improvement of the overall education program, the authors examined teachers' teaching methods, curriculum designs, study evaluation methods, study support systems and methods, as well as students' study time outside of their class rooms.



Figure 1. Leadership education program design.

Quality Improvement of Leadership Education Program

This leadership education program has been conducted since 2008. The above PDCA cycle has been repeated in order to improve quality of the education program in three stages (program $A \rightarrow B \rightarrow C$) (Figure 2) (Maruyama & Inoue, 2011; 2014; Inoue, Maruyama, & Nagaya, 2014).



Figure 2. Leadership education program improvement.

Continuous and Gradual Quality Improvement and Goal Attainment Level

Stage 1 (Program A)

Program A was conducted between the 2008 and 2010 fiscal years. Students first acquired knowledge and theory on leadership. Then for their application, students utilized simulation to experience leadership actions many times. Simulation provided a safe environment in which they could try out many different approaches and students could widen their leadership actions in various situations. Also, they realized the tendencies of their own thoughts and actions via simulation and got clues to improve their actions. In the next step, students applied the above simulated experiences in actually taking leadership in their research seminar and lives.

Moreover, they reflected on their real actions and again trained themselves with simulation. This cycle was continuously repeated. A 360-degree assessment was carried out by teachers, senior, and junior students before and after the class. With assessment results, the authors made sure that students were able to apply simulated experiences for their actions in research laboratories. The level 3 "action" was achieved (Figure 3). In particular, the achievement skills for their goals were raised, as well as the control skills of tense emotion.



Figure 3. Feature of the 1st program.

Quality Improvement in Stage 2 (Program B)

Program B was conducted between the 2011 and 2012 fiscal years (Figure 4). The authors added repeated practices on role play between simulation and real actions with the results of course evaluations from Program A. In role play, students could practice with an actual person on simulated experiences in simulation. This lessened the gap between reality and simulation, so that students were able to be less resistant to take leadership. Also, it provided practice in reading emotions of the other party through facial expressions and tone of voice. In terms of study evaluation, 360-degree assessment was carried out before and after the class. At the same time,

rubrics and learning portfolio were introduced so that students could easily achieve their goals and measure the degree of their own growth by themselves. Especially from learning portfolio, they became aware of the importance of communication in technical activities and positively operating research laboratories and seminar. This paper confirmed the level 3 achievement on knowledge, consciousness, and action in the study accomplishment levels.



Figure 4. Feature of the 2nd program.

Quality Improvement in Stage 3 (Program C)

Program C was conducted in 2013 (Figure 5). With the results of course evaluation from program B, the findings showed that it would be necessary for students to get more chances of leadership action to achieve the level 4 "mastery". Therefore, it gave students such chances in project based learning (PBL). Such PBL requires teamwork between students of multidisciplinary groups and demands goal attainment. Therefore, PBL gives students challenging situations with tension and pressure that they do not have in research laboratories, seminars, and lives. Moreover, as the team is composed of students of different disciplines, students are required to have communication skills. In order to promote mutual understanding toward the project thorough explanations and meaningful communication, they must expend more energy and pay more attention when relating with people of different disciplines than with those of the same discipline.

Utilizing all the chances in such situations, they practiced leadership actions. With the results of the evaluations given by the leadership assessment in PBL, a 360-degree assessment, and rubrics, the findings showed that students gained knowledge, awareness, and achieved action levels. In addition, after finishing the course, students spontaneously took leadership actions and some joined international PBL. Half a year after the course, the interviews were carried out with students regarding the impact of this education program and PBL and gave them emotional quotient tests focusing on emotional aspects of human relation skills. With the above

assessment results, the findings showed that their leadership skills were raised via the synergetic effect generated by this leadership education coupled with PBL. In particular, their human relation skills were raised and they showed better actions in relationships. Thus, it confirmed the level 4 achievement, mastery.



Figure 5. Feature of the 3rd program.

Conclusions

With the goal of quality assurance of a class curriculum, the PDCA cycle was applied on leadership education on graduate students of engineering, resulting in seven years of continuously improved quality of the education program in which students achieved their learning goals.

In this cycle, students acquired knowledge, utilized simulation, applied simulated experiences toward reality, and reflected on their real actions. Thus, this cycle led to the level 3 achievement to enhance transformation of action and even to the level 4 achievement, mastery of their new actions in leadership.

References

- Aldrich, C. (2004). Simulation and the future of learning—An innovative (and perhaps revolutionary) approach to e-learning. San Francisco, CA: Pfeiffer.
- Dragan, Z. M. (2003). Project management tool box tools and techniques for the practicing project manager. Hoboken, NJ: John Wiley & Sons, Inc.
- Inoue, M., Maruyama, T., & Nagaya, H. (2014). Project management education embedded in engineering education and research for fostering generic skills. Proceedings from *INNOVATIONS 2014: World Innovations in Engineering Education and Research*, iNEER, Potomac, MD, USA.
- Ishii, T. (2015). Introduction of learning records into task-based PBL education. *Kisarazu National College of Technology*, 48, 29-36.

Komives, S., Lucas, N., & McMahon, T. (2013). Exploring leadership. San Francisco, CA: Jossey-Bass.

Maruyama, T., & Inoue, M. (2011). Leadership education in conjunction with real experience and pseudo experience with the use of simulator. *Journal of the Society of Project Management*, 13(4), 32-37.

- Maruyama, T., & Inoue, M. (2014). Design and validation of leadership education integrating simulation and project based learning (PBL). *Journal of the Japanese Society of Engineering Education*, 62(6), 75-80.
- Mine, A. (2012). Revolution of methodology for improvement of the social studies lesson—Spiral PDCA cycle based on difference in quality formation. *The Journal of Social Studies Education*, 1, 11-27.
- Otsuka, M., Mizukoshi, K., Watanabe, Y., & Yatsushiro, K. (2015). Development of teaching and assessment support system for lesson study. *The Information Processing Society of Japan, 2015-CE-129*(8), 1-6.
- Palmer, P. J. (1998). The courage to teach: Exploring the inner landscape of a teacher's life. San Francisco, CA: Jossey-Bass.