The real world demands the capabilities to identify a problem and to find its solution [1]. A previous study using a questionnaire survey of physics graduates suggested that the most important abilities acquired from physics courses are extracting an essential issue and building a model, presenting one’s ideas logically and understanding the principles of new technology [2]. Physics enables the deduction of a conclusion based on a limited number of fundamental principles and provides experimental predictions for unknown situations. However, typical Japanese students have come through a system which is exam oriented and have become accustomed to taking in as much information as they can in order to get good grades.

Our physics department set the goal of our four-year undergraduate curriculum as 'development of student abilities to integrate multidisciplinary fields of science and technology in order to explore new interdisciplinary fields'. We defined four developmental stages, study(S), analysis(A), innovative design(I) and logical presentation(L), throughout this curriculum [3]. The SAIL program includes a project-based learning course and introductory courses.

We created a project-based learning course that illustrates devising a solution to a problem through a systematic problem-solving procedure. This course is followed by poster sessions to experience intensive discussion with teachers and classmates. We devised assessment checkpoints to determine whether the students learnt a systematic procedure for problem solving. The students were required to give a verbal description of physical principles and reasoning process based on their observations. We set this skill in verbal description to be one of the most important requirements for diploma.

This project-based learning course cannot provide effective educational benefits unless the students have already learnt the methods for evidence-based logical synthesis. We also opened introductory courses to teach students how physics should be studied questioningly and purposefully and how to deduce basic laws. We expect that students’ logical presentation skills should be supported by their analytical abilities learned in the introductory courses. Analysis and deduction are fundamental for collaborations with other scientists and engineers. Hence, we have announced basic qualifying standards for the entrance examination. The admission criteria are (1) students’ intellectual curiosity and potential capability of deepening the interest through experience and observation, (2) a thinking capability of the reasoning from cause to effect, and (3) a skill of responding quickly to others and getting to the point of the arguments.

In conclusion, we validated the consistency of the four developmental stages established for an undergraduate curriculum, in relation with the admission and diploma policies. Our educational concept, SAIL, is expected to become a model system of physics education for the real world.