1. Introduction

The Tohoku University Creative Engineering Center (Innovation Plaza) was established on July 6, 2001. This center is in a modern, newly constructed two-story building and located next to the engineering library. The center has an exhibition room, a computer room, an innovation theater, a machine shop, a material processing room, a chemistry laboratory, a digital atelier for 3D graphics city models, a digital prototyping room and a VLSI design room.

(1) Exhibition room

The exhibition room with a high-ceiling area is connecting the first and second floors. The exhibition room is used for displaying results of student activities and special community events. Some of the exhibitions are science classrooms in “Children Science Campus” for elementary school students, student research projects, science demonstrations, robot contests, announcements and workshops etc. that were held in the past.

![Innovation plaza](image1)

Fig. 1  Innovation plaza

2. Objective

The center has been used for training of Team-Based Engineering Design Course for the first grade students, and the basic experiment for the student education with creative engineering. The creative engineering education has been carried out since 1996 and participants are steadily increasing.

The center also provides community services and programs for elementary, junior high and high school students during spring, summer, autumn and winter vacation period, especially, “Children Science Campus” for elementary school students, “Science School” for junior high school students and “Science Camp” for high school students.

3. Functionality and activities

The access to the home page of the Innovation Plaza on a website is recommended to obtain the latest information and activity schedules.

http://www.ip.eng.tohoku.ac.jp.

A brief description of each room in the center is given as follows.

(2) Computer room

In the computer room, twenty-five personal computers can be used for the information retrieval and reference collection using Internet access and for the arrangement of experimental data and the preparation of a presentation manuscript, etc. Students can use an imaging scanner, a monochrome laser printer and color printers of ink-jet system.

(3) Innovation theater

The innovation theater is used for multipurpose, student experimentation and a space to assemble and construct student projects. Especially, a video conference system is installed in this theater for video conferences between foreign country university and Tohoku University. Moreover, it is used also for school student’s science classrooms and the intellectual service to a community during open campus.
(4) Machine shop
The machine shop is an area that allows students with proper supervision to form and cut materials such as plastics, wood and metal. Lathe turning machines, mills, drills, grinders and other machines are available. Using these tools, materials can be formed into the desired shapes based on the student design. It is possible to cut, grind, bend, turn off, puncture and screw the material. Student’s imagination and creativity can be realized and embodied in various forms.

(5) Material processing room
The materials processing room is for learning about the properties of materials such as metals, ceramics, plastics, glasses, woods and composite materials. Students can examine mechanical, electromagnetic, chemical, optical, thermal, acoustical, and other properties of materials. In this room, the main properties that can be examined are mechanical properties. Students can make fracture tests and investigate the arrangement of crystalline forms of the materials with an optical and/or a digital microscope.

(6) Chemistry laboratory
The chemistry laboratory allows students to perform experiments in inorganic chemistry, organic chemistry, biochemistry, chemical engineering, and related fields. The most important equipment in this room was the Shimadzu MALDI-TOF mass spectrometer installed in 2003. This mass spectrometer was developed by Mr. Koichi Tanaka who won the novel chemistry prize in 2002 by development of soft desorption ionization for mass spectrometric analyses of biological macromolecules. Mr. Koichi Tanaka graduated from Tohoku University, Faculty of Engineering and his achievement gave us big joy and courage. At present time, the equipment was moved to another building to be used effectively.
(7) Digital atelier
The digital atelier is the studio for engineering artists and designers. Students can use three-dimensional computer graphics (3DCG) system for creating models of cities to study city planning and arrangements and also building design, living spaces, and structures. The 3DCG system allows student designers to transfer their drawings and sketches to models that can be rotated, moved, or enlarged. For example, student designers may take two-dimensional scale drawings and then create three-dimensional solid or wire-frame drawings. Students can create photographically-realistic images of the city or buildings which has not imagined so far. Visualizing a design makes it possible to create comfortable, secure, and attractive city environments that have a positive influence on the people in a community that is in harmony with nature and the environment. The 3DCG system in the digital atelier allows students to plan the future cities.

(8) Digital prototyping room
The digital prototyping room has a Computer-Aided Design (CAD) software and equipment. CAD is the foundation of precision mechanical drawings used in the finest technical engineering sciences. A three-dimensional mechanical design can be automatically created from conventional two-dimensional drawings or sketches with CAD software. The rapid prototyping (RP) equipment, which is similar to making models manually by hand-molding clay, can make three-dimensional solid models precisely and automatically by laminating heat-sensitive resins having a diameter of about 0.5 mm. In this way, actual solid structures can be made from only computer software and student imagination. Formal processing software can also be used to allow geometric analyses of complicated mechanisms such as rotations or moments of inertia or links to control or simulation software.

(9) VLSI design room
Technology for communicating, recording and reproducing digital signals or images is playing an important role not only in engineering education but also in our everyday life. In order to realize this technology, an Integrated Circuit, IC and the highly efficient micro-sized processors are used. The equipment and hardware installed in the VLSI (Very Large Scale Integration) design room can assist students in making their original designs of these micro-sized processors. A hardware description language and Field Programmable Gate Arrays (FPGA) are used. Students can design multimedia information and communication system with the digital processing facilities in the VLSI design room.

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4. Children science campus
The children science campus has been annually held for two days during the spring, summer, and autumn vacation since 2002. Ninety students come to join the "Children Science Campus" from elementary schools every day during such events. Recent topics of science classroom in the "Children Science Campus" are concerned with (1) mechanism of clouds formation, (2) magnetism, (3) city design using 3DCG, (4) casting, (5) vegetable gene/slime and (6) spinning tops using CG etc. The children who participated in the "Summer Children Science
“Campus” joined the open campus held on the same day after the science classroom. They visited laboratories to enjoy exhibitions and experiments.

5. Closing remarks
Through a wide range of activities and exhibitions at Innovation Plaza, the number of annual participants is increasing over 10,000. The faculty and staff of Tohoku University Creative Engineering Center (Innovation Plaza) hope that the facilities and resources at Innovation Plaza will provide with an enriching and rewarding experience in learning about science and engineering for students, children and teachers, and become a part of your lifetime learning experience.