



FreeForm® Concept™ Customer:  
Shonan Institute of Technology, Japan



Professor Seiji Wada, Dept. of Mechanical Design Engineering, The Faculty of Engineering. In October of 2004 10 Seats of FreeForm Concept were brought into the classroom at the Shonan Institute of Technology. In April 2005 eight of those systems were taken into the classroom of the 3<sup>rd</sup> grade and the other two systems have been installed in the laboratory for an assignment of the 4<sup>th</sup> grade. <http://www.shonan-it.ac.jp/index.html>

### Education in Japan: Background

Due to the drop in the national birth rate, 2007 will be a turning point for Japanese universities and institutions as the numbers of matriculating students falls below the total admissions capacity. The drop in incoming students means that many institutions may find it financially difficult to keep their doors open. Competition for students between medium sized institutions, like Shonan Institute of Technology, is increasing. Institutions need to establish curriculums that stand out from others to attract students and ensure financial stability. In an effort to build a more compelling curriculum the Shonan Institute of Technology has recruited professors and lecturers with significant industrial experience from recognizable companies.

### Shonan Mechanical Design Department

Professor Seiji Wada is one of the key people in the Shonan Mechanical Design Department; he has vast professional experience: as a lead consumer designer at the Mitsubishi Electric Design Center for 30 years and as a chief. Professor Wada recognized that the skills of graduating engineering students were limited to operating CAD packages and other 2D software. In his opinion they were lacking 3D design concepts. He feels that industrial design and engineering students who grasp 3D design concepts produce better more competitive products.

In 2003, the Shonan Institute of Technology established the department of Mechanical Design Engineering for the aim of "Bringing the methodology of design to the engineering curriculum to produce mechanical engineers who understand design concepts." Having engineers who understand 3D design, even though they are not designers, can make the production workflow more efficient.

Previous approaches taken to bring 3D concepts to the classroom were met with lukewarm reception by the students. Students got mired in the mundane aspects of learning 3D design; they showed no enthusiasm and little interest in learning. When a FreeForm user introduced Professor Wada to the SensAble FreeForm Concept 3D modeling system and the advantages of industrial design, Professor Wada realized that in FreeForm Concept he had found the tool that would bring 3D design concepts into his classroom in an intuitive and fun way. After bringing the FreeForm Concept system to the classroom the students enthusiastically embraced learning 3D design concepts and began to intuitively create 3D models.

The Department of Mechanical Design Engineering offers many practical classes within the 3<sup>rd</sup> grade curriculum. The theme of one of the main classes offered by his team is how to use 3D design concepts to design a kayak. He also takes this theme into his laboratory by 4<sup>th</sup> grades students as well as another class for the 1<sup>st</sup> grade. To introduce 3d design they do clay modeling.

### Why a Kayak?

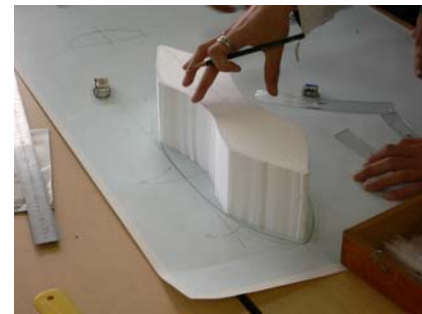
In the current world of product design and manufacturing it is imperative that engineers understand the end user's needs. It is Professor Wada's primary goal to have the students produce something that contributes to society. He chose the kayak so that the students would learn to consider the research of the rehabilitation needs of handicaps in their design. He felt the kayak would be a suitable theme that would help students to think in terms of 3D shapes and show them how to design

using a hybrid of digital and analog methods.

### Training to Think in 3D - the 3<sup>rd</sup> Grade

The class is a 4 week course, 3 hours per week. Over the course the students work in groups to design a 3D kayak; each group averages 10 to 12 students. The class resembles a professional workflow very similar to that which is used in a real production flow of consumer products.

1<sup>st</sup> week - Brainstorming: The students break out into teams of 4 or 5 and each team discusses what they are going to produce and which shape with which concept. In the early stage of brainstorming Prof. Wada provides the students with some rough requirements that were gathered by his team. The students are encouraged to use their imagination, to visualize 3D models. After brainstorming the students are asked to create a plan that describes the particular shape and size of their design and how the way the paddle system of their design relates to sports and to the rehabilitation needs. They are also asked to assign roles to each group member.



2<sup>nd</sup> week - The students start working. One or two of them draw the plan of the model in 2 dimensions with front and side views, and the others start to create a 3-dimensional, scaled-down model of the kayak by hand using traditional sculpting tools. Generally students in the Mechanical Design Engineering program have never used a radius ruler or smoothed a form with a file and sandpaper. With the assistance of the professor and the lecturers, the students get accustomed to creating a model in real 3D by using equipments and tools. After they have completed their design, the students give a presentation of their model and the 2D drawing. By this stage, the students have learned to achieve a real 3D design through team work using traditional modeling tools.

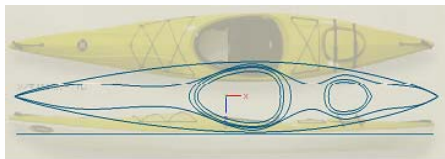


3<sup>rd</sup> week - With the experience of creating a model in the real 3D world over the last two weeks fresh in their minds, the students are introduced to the FreeForm Concept system. Prof. Wada says "3D CAD is not used because what I want is to emphasize the natural experience of creating 3D models using a more intuitive digital tool like FreeForm Concept. That is the core of the education policy in the Dept. of Mechanical Design Engineering." Of course, the students already had CAD skills as there are classes to learn 3D CAD in the 2<sup>nd</sup> grade in the Institution. Prof. Wada adds "it makes sense that they easily understand xyz axis in the digital tool FreeForm Concept taking depth, width and length, after the real workflow." Amazingly,

because of the use of the sense of 3D touch that the PHANTOM Omni haptic device brings, even the students who don't particularly like CAD operation are fascinated with the FreeForm Concept system for learning digital clay modeling. 4<sup>th</sup> grade students from the previous year took a few months to create a 23 page tutorial that shows how to create a kayak. Students have been able to complete the kayak model in FreeForm Concept after only the 20 minute demonstration of this tutorial.



The alumnus in spring of 2005 helped the professor and lecturers to prepare the tutorial with pictures and views that easily explain how to create a model In FreeForm Concept. Using this tutorial, one student created a model in 45 minutes. Most students have successfully created a kayak in 80 minutes. It takes 60 minutes on the average.



Example pages from the original tutorial



ABS model output by RP machine

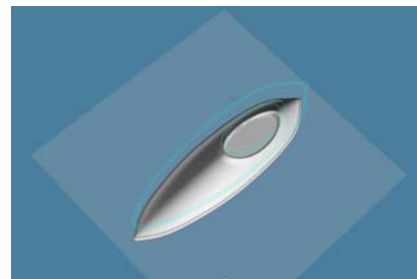
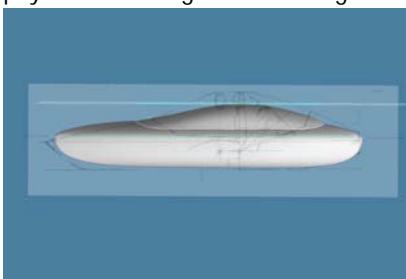


4<sup>th</sup> Final week - The classroom chooses one model from 3 or 4 physical models that the students made and then all of them try to create 3D model of that one design using the FreeForm Concept system. The lecturer shows example workflows for making the model before the students start modeling to give them ideas on how they can organize their workflows. It is only the second time students have been able to interact with the FreeForm Concept system. At this point they have only had three hours the previous week using the Concept system and amazingly they are able to finish models with the FreeForm Concept by themselves in only 3 hours.

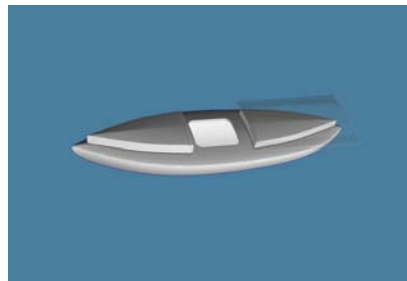


*Two students are sitting at a system working collaboratively to create their model.*

The students have learned a great deal about production over only 4 weeks and in only 12 hours; from brainstorming to physical modeling to intuitive digital clay modeling.



*The models by students in the classroom were done in 2 or 3 hours.*



From these classroom experiences, Prof. Wada has gained enough confidence to expand the class using the FreeForm Concept into 1<sup>st</sup> grade in 2006.

SensAble Technologies, Inc., 15 Constitution Way, Woburn MA 01801. Tel +781-937-8315, Fax +1-781-937-8325  
Web: [www.sensable.com](http://www.sensable.com), Email: [Info@sensable.com](mailto:Info@sensable.com)