Introduction

Research Motivation

A suitable online learning environment that meets needs of users will enable students to fully enjoy platform resources and enhancing learning performance. In design field, given the vigorous development of digital technology, the original design mode of using traditional tools or hands-on analog physical objects has undergone substantial changes. Traditional design has achieved a sense of consistency and innovation, and the means of communication have been improved (Haymaker, Keel, Ackermann, & Porter, 2000; Phelan, 2006). Therefore, online design education has considerable importance. However, compared to other fields, the development of online design education has been very slow. The reasons include the difficulties in digitizing design teaching materials and products (Chou, Yang, & Huang, 2010; Fleischmann, 2011), and the functionality of current online learning platforms does not meet the needs of design education (Kalay, 2006).

Previous Research

Web-based instruction is essential for design education because the integration of computer technology has allowed designers to consistently and innovatively use design approaches. However, common platform functions fail to meet the needs of design students. Based on previous research (Hsu, 2013; Yen & Hsu, 2007), a computer-assisted support system that can support and enhance group collaboration, named CSCD (Computer Support for Collaborative Design) platform, was constructed that meets needs of design students and provides effective tools for interaction and collaborative learning by integrating mind-mapping tools into a learning environment.

The design model of the CSCD platform is based on the users' needs, which covers course information, teaching content, students' work, and learning tools in the top middle portion of the homepage. The learning tools include mind mapping, work display, electronic whiteboard, course discussion, virtual classroom, audiovisual media, and related links on the right side of the homepage (Figure 1).

Figure 1.　CSCD homepage

In order to provide space for displaying students' works, and thereby interact and discuss with team members during the product development process, the CSCD platform provides learning tools, include Work Display (Figure 2), Video Works (Figure 3), Online Discussion Board (Figure 4), and Online Virtual Classroom (Figure 5) served as a collaborative design environment.

Most important, the CSCD platform provides a Mind Mapping tool to enhance students' creativity, support collaborative design, and thereby complete the process of brainstorming. Students create mind mapping sketches using the X-Mind program and upload the sketches to the platform. The rotate, zoom-in and zoom-out, or full-screen functions can be used to view mind maps (Figure 6).

Purposes of This Study

The main purposes of this study were: (1) to understand the learning attitude and learning performance of students using the CSCD platform to support collaborative design and its impact on creativity; (2) to understand the learning attitude and learning performance of students in their application of collaborative mind mapping in the design project and its impact on creativity; (3) to understand the students' degrees of satisfaction in using