**Tsinghua-SUTD/IDC Research Collaboration**

-- Plug Design into Learning

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**1. Background**

This document is to propose collaboration of Tsinghua-Toyhouse and SUTD-IDC, specifically from two aspects:

1. Co-develop Design-Centered Learning Activities at Tsinghua and SUTD-IDC.
2. Cooperation on Engineering Education Research.

We invite students and researchers from SUTD-IDC to visit Tsinghua University. They will design learning activities and co-conduct Engineering Education research together with people at Toyhouse.

**2. Co-develop Design-Centered Learning Activities**

Based on the theme of “Design a Sustainable Digital Nation”, three workshops will be organized as eXtreme Learning Process (XLP) activities between July and September: Tsinghua International Summer Student Program (August 3 – August 10), XLP Junior (August 8 – August 20), Lego2Nano (September 1 – September 8).

The preparation phase starts from July. We invite **3+ students and 2+ researchers** from SUTD-IDC to come to Tsinghua University during **July and August** to design the activities with students at Tsinghua University. They will be the “Challenge Designers” of other incoming students during August and September. They will bring design projects and ideas into learning activities. At Tsinghua University, they will participate in the following projects (not limited to these):

1. Architecture design and prototyping for CO-OP buildings in the digital age

In this project, we will guide summer participants to adapt methods for sustainable design with relevant digital design tools to articulate architectural plans of CO-OP buildings for college students living around campus. They will focus on plans and functions that utilizing sensor network technologies to reduce energy consumption and improve knowledge exchange activities. The expected outcome is a set of digital documents or solution templates that can be utilized by students around the world.

1. Computational Infrastructure for Design

Modern design activities must leverage a suite of computational services. Knowing that SUTD-IDC has a number of computational services for designers, we would like to co-design an intensive workshop that introduces computational tools and services that to inter-disciplinary design teams. The outcome of this activity is to conduct a few experimental workshops at Tsinghua and produce an operating manual for this Workshop on Computational Infrastructure for Designing Teams.

1. Low-cost instruments for nanotechnology research

Starting September 1st, 2013, Ph. D. students from UCL, Tsinghua, and PKU have been invited to design Atomic Force Microscope (AFM) using low-cost materials and devices such as LEGO at Toyhouse. The goal is to produce a 100 USD LEGO kit for AFM-like experiments for high schools or elementary educational institutions. We hope to apply the design document templates, and the computational design workshop as prescribed in item (a) and (b) to this project.

**3. Engineering Education Research**

We invite **2+ students and 2+ researchers** from SUTD-IDC to co-conduct Engineering Education research at Toyhouse. The goal is to start experimenting with a 100+M2 learning environment during the summer. This physical place will be dedicated to trans-disciplinary learning activities. Related to the design of a “model”  
physical learning space, we plan to conduct three relevant research projects during this summer:

1. Learning outcome measurements mechanisms for Design Education

XLP is designed to create a realistic inter-disciplinary working context that can create learning outcome data for education research. We already have a dedicated team to design outcome measurements and data collection mechanisms by applying analogies from currency exchange markets. Specifically, we are studying BitCoin, as a model for secure and fair knowledge asset exchange mechanisms. We would like to have SUTD’s personnel involved in the design phase of these measurement selection and mechanism design. One aspect of this research is behavioral/process modeling and relevant data collection/analysis. We hope that SUTD-IDC can provide expertise on abstracting the behavioral model of inter-disciplinary and inter-cultural design activity. The expert(s) can be either on-site in Beijing, or communicate with us remotely. In any case, we would like to have at least one SUTD representative here in Beijing to help us identify the right personnel in the overall SUTD organization to get involved in this project.

1. Testing Design Methodology during Live Events

This summer, we want to introduce a set of design methods to guide students of different backgrounds in collaborative idea generation and refinement. Therefore, we hope to have “design method experts” from SUTD-IDC who can conduct short Just-In-Time-Teaching (JITT) during these workshops. These experts will work on-site to train Challenge Designers or work directly with Missionaries to supply methodical design expertise during the actual workshops. The outcome of this research is a set of JITT (highly condensed, yet generally applicable) pedagogical material dedicated to intensive workshops.

1. Learning Workflow Modeling for trans-disciplinary design activities

Learning activity can only be repeated when supported by a rigorous, yet adaptive process model. With researchers from SUTD-IDC, we plan to create a set of generalizable, yet configurable and context-aware process models for design activities based on workflow modeling experts. We already have been working on this using formal workflow modeling languages such as YAWL (http://www.yawlfoundation.org/). We hope that this model can be developed and tested by our joint effort.

**4. Project Schedule at Toyhouse**

Jun 15 – Aug 2 Preparation Phase of Summer Learning Activities

Aug 3 – Aug 11 Tsinghua International Summer Student Program

Aug 8 – Aug 20 XLP Junior

Aug 21 – Aug 31 Preparation Phase of Lego2Nano

Sep 1 – Sep 8 Lego2Nano Workshop

Jun 1 – All Related Engineering Education Research

**5. Invitation Summary**

The following table concludes the number of students and researchers we hope to invite from SUTD-IDC.

|  |  |  |  |
| --- | --- | --- | --- |
| Date | Student | Researcher | Project |
| Jun 15 – Sep 10 | 3+ from IDC | 2+ from IDC | Learning Activity Design |
| Jul 1 – Aug 30 | 2+ from IDC | 2+ from IDC | Research Collaboration |

Note: We hope that SUTD-IDC will provide living and dining cost for students and researchers from SUTD-IDC, as well as any other costs such as transportation, medicine, and so on.

**6. Budget**

Estimated cost for each student/researcher is listed in the following table:

|  |  |  |
| --- | --- | --- |
|  | Monthly Cost (USD) | Total (2 Month, USD) |
| Accommodation | 1500 | 3000 |
| Transportation | 500 | 1000 |
| Dining | 1000 | 2000 |
| Total | 3000 | 6000 |

In total, nine people will cost about 54,000 USD.

Tsinghua University will cover regular development costs during learning activity design and research. SUTD-IDC will need to cover potential costs on design related research projects, including materials, devices, expert fees, and so on.