A Scheme of Resource Discovery in Reproductive Design Education

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ABSTRACT

Design education is one of the most creative topics and themes in Higher Educations and Trainings. Students of the design education course also need to learn both of knowledge and techniques, the former is necessary to design some objects and the latter are essential to utilize tools as well as equipments. It is important to provide not only knowledge but also techniques in efficient and effective ways. One of the most attractive approaches to design in Ecological and/or Recycling methods is to utilize and discover reproductive tools and resources. It is a good way to create some reproductive objects. Especially, some furnitures are worth enough to be reused and reproduced in the above ways.

This paper focuses how to utilized recycling resources and useful knowledge for design education. And it also presents a practical scheme to utilize Resources, Knowledge and Techniques for Design Education in order to retrieve and discover in the network environment.

The paper challenges to visualize practical scheme for design process by means of comparison between usual steps in the normal design education and special steps using Internet and network community. And it summaries to be important for design education to visualize scheme for resources and knowledge discovery through network environment.

KEYWORDS

Visualization of Design Education, Ecological and Recycling methods for Design, Utilization of Network Community for Retrieving and Discovering

1 INTRODUCTION

Education, especially Design education, needs combination of knowledge and techniques. Because students of the relevant education course must have suitable knowledge to design some objects as well as applicable techniques to produce original shape and structure for the self-designed objects.

In order to grow their knowledge and techniques during the effective course, students and/or learners want to face some practical designing and producing situation which can provide very important experience to the relevant students/learners. If they find them in successful results, they will really gain possession of skills, great experience, self-confidence and more over applicable challenging spirits for other targets.

In these cases, there may be some problems how to support and realize their fruitful courses and how to reduce / shorten their reasonable periods for the total length of courses. Many students/learners need different knowledge and materials and they want to face several kinds of target and plans to design and implement their objects. This paper has focused usage of network community to retrieve their suitable knowledge and find their desired resources for the sake of resolution of their problems. Network sometimes shows a lot of scenes to its users, from domestic LAN to wide WAN i.e. Internet. Currently, social networks become more and more applicable for their users for information sharing and exchanging.

This paper introduces brief comparison of conventional and our proposal design education with network community and benefits in the next (second) section. It explains characteristics and advantages of our practical design education for reproductive scheme with recycling resources and its ecological style in the third section. It also describes trial evaluation of our design education and mentions its future expansion for Internet-wide scale in the fourth section. And it finally summaries our conclud-
ing remarks in the last (fifth) section.

2 COMPARISON BETWEEN CONVENTIONAL AND PROPOSAL DESIGN EDUCATION

This section compares our proposal design education with a conventional one and reveal the former’s characteristics against the latter’s one. At first we shows a conventional design education for furniture producing with some materials. And then we describe our approach for proposal design education with Network Community.

2.1 Example of Real Production Process for Furnitures

A real production process of furniture includes the following steps;

1. Design of the target furniture: normally, some prototying is necessary in the design process. Making miniature is a part of prototyping. It is convenient for overviewing such a target furniture.

2. Discussion of the target furniture: Designer(s) and sale manager(s) discuss the profile about the target furniture by means of miniature as a prototype. Some sale plan is to be prepared by means of prototyping, namely using miniature.

3. Production of the target furniture: After prototyping and discussing, producing process begins in accord with previous processes. Display and trial usage will be available with finished product(s).

Figure 1 shows prototyping a miniature of reference furniture on the work desk. In this case, prototyping includes coloring of miniature. Suitable coloring may be good for the sake of giving reality to miniature. Scaling of miniature will be from 1/10 to 1/8 possibly.

Figure 2 presents the according miniature of furniture with the same kind of miniature of seat sofas which have been made up of “foam polystyrene” because of easy forming. Such a prototype, however, may give someone a quality feeling so that some people say there is no special need to utilize Virtual reality rendering with expensive effect by computer.

As comparison with Figure 2 and Figure 3, not only designer(s) but also sale manager(s) can feel that real production is identical with prototyped miniature. As a consequence, potential buyers who may stand at the same position of sale manager can recognize and decide to pay their costs to buy the relevant furniture only through reference of prototype. As you know, not a few people sometimes buy products only with reference of catalogs or online browsing,
instead of touching and checking real model.

### 2.2 Proposal Design Education for Reproduction using Network Community

Network communities have been attractive and useful for us to perform information exchanging and sharing among the registered people who are living in the distance[1]. If one describes some resource is unnecessary in network community, others may rely those resources must be necessary in the same community. And if one asks some questions which need knowledge to be resolved, others may reply the relevant answers which include suitable knowledge for resolution. Network community is one of the efficient and effective environments which can transfer information to the relevant position/people.

In order to perform resource recycling and discovering, it is very good to utilize Network Communities and carry out information exchanging and sharing on the networks[2][3]. In the case of our proposal design education, recycling resources of materials has been focused and illustrated in order to reproduce some useful products with recycled resources. We will explain sample of utilization of Network Communities, decision making on the networks (i.e. resource finding, knowledge obtaining to redesign, presenting by miniature, discussing, etc.), reproduction of real model, and evaluation.

Generally speaking, reproduction of furniture may be included with the following procedures, namely,

- Designer reforms his/her original model into a new one, which has both of a part of the same resources of the original model and other new parts.
- The designer must decide to keep what part of original resources and to design others newly.
- In order to decide to keep what part of original resources, it is necessary to retrieve past results. On the other hand, in order to decide to create new part, it may need to search future trends, namely, prediction of trend.
- The former must utilize retrieval of past track records just like as one of Database applications, while the latter had better employ market research, trend watching, questionnaire investigation for users and so on.

Of course, it is very difficult for only one or a few designers to manage the above procedures efficiently. Several staffs and/or support team must be necessary for such designer(s).

We describe schematic procedure for reproduction during Design Education using Network Communities in order to improve effectiveness and efficiency educational results.

- In order to accomplish retrieval of past track records, we have utilized Network Community. Such a community can play important roles to provide huge and excellent Database for retrieving.
- We have also utilized Network Community to perform market research, trend watching, questionnaire investigation, and user’s demands. Probabilistically speaking, small size of Network Communities may have not large demands but steady ones even for productions.
- We have employed Network Community as suitable media to perform information sharing and exchanging. Namely, some
members of Social networks may be able to provide and/or point out both of resources and know-how for reproduction in Design Education.

- As described before, values of people may be not similar and identical. If so, it must have possibilities that something which is unnecessary for someones is necessary for other ones from the global viewpoints.

- Especially, recycling will be more and more popular in many fields and may domain. Production, such as furniture, has relatively long lifetime such as 10 years or more, so those resources may be useful and available for multiple generation users. The problems are how to adjust changes and variation of their tasty, favorites and trends.

In the next section, we will introduce detail of recycling furniture using Network Community as a practical example of our proposal design education.

3 CHARACTERISTICS AND ADVANTAGES OF PROPOSAL DESIGN EDUCATION

This section demonstrates characteristics and advantages of our proposal design education showing practical reproduction processes of recycling furnitures as a sample problem. The section includes workflow of reproduction of furniture, explanation of detailed stages for real reproduction and modeling as resource discovery using Network Communities.

3.1 Workflow of Practical Reproduction

First of all, workflow of reproduction of furnitures can be summarized as follows. Such workflow utilizes resources and know-how using Social networks based on Internet. All the operations and functions are especially geared towards Social networks and also intended for users of such network communities.

1. Furniture Designing stage:
   - Choosing kinds of furnitures
   - Determining kinds of materials

2. Resource Finding stage:
   - Requesting information about furnitures to be constructed
   - Requesting information about materials of the furnitures
   - Searching resources for materials/furnitures
   - Obtaining information about resources
   - Obtaining information about resources

3. Knowledge Collecting stage:
   - Requesting information how to fabricate, manufacture and/or process such resources
   - Searching knowledge for fabrication, manufacturing and/or processing
   - Obtaining knowledge about the above techniques
   - Accumulating knowledge like Database

4. Furniture Constructing stage:
   - Selecting staffs and/or work places
   - Pouring resources and know-how (i.e. knowledge) into the above factory (i.e. workplace with staffs)
   - Reproducing (Constructing) the relevant furniture(s)

The above workflow can be separated into 4 major stages, which includes some more detailed steps.

3.2 Reproduction Modeling for Proposal Design Education with Resource and Knowledge Discovery in Network Community

We have utilized Network Community in order to obtain “Requests”, “Resources”, “Knowledge” and “Announcement” for Modeling for
Proposal Design Education. Our sample is to reproduce some furniture using Resource and Knowledge which are retrieved and discovered in Network Community.

First of all, we have established Human relation for Demand analysis, Trend retrieval, Decision making, and so on. Social networks are powerful and reliable for us to achieve our aim relatively in a short period. They are very useful and suitable to perform information sharing and exchanging in convenient ways.

Figure 4 shows such human relation realized in Network Community such as in Campus network environment. Of course such a community may not be limited to local and/or domestic community in the same campus(College and/or University). It can be more widely spread and enlarged like Social networks, for example, Facebook[4], Mixi[5] and/or Twitter[6]. Frankly speaking, probably it is not necessary to restrict Social Networks to so-called SNS(i.e. social network system like Facebook). Twitter[6] community, Community FM (Radio Broadcasting) and other similar ones may be sufficient enough to perform Human relation if it satisfies almost all conditions described in subsection 3.1.

In the case of reproduction of furniture, it is very much necessary to find useful resources efficiently. With utilization of Network Community, finding resources can be carried out more easily than others shown in Figure 5.

If a user asks his colleagues in Network Community whether convenient resources exist close to your or not, some colleague replies his/her information about according resource. Of course, it is possible that others do not reply in a short period nor reply only they know nothing about such resources. Probably suitable resources will be found potentially in a short period through human relation established with Network Communities. This is an example of “Resource Discovery by means of Network Community”.

In the same manners, if a user wants to obtain some tools and know-how to reproduce furniture efficiently, he asks his colleagues, “Does anyone know where suitable tools are ?” or “Does anyone have adequate information how
to reproduce such kind of furniture?" This is also an example of "Knowledge Discovery by means of Network Community". Figure 6 shows that a user has obtained a necessary tool from Network Community and he/she can use the relevant tool for Design Education in order to achieve his/her purpose and/or target in a short period.

If a user is a beginner of our Proposal Design Education who cannot reproduce such a furniture by himself, he may want to know how to (re)produce good furniture with his resources. So he needs several kinds of knowledge to use resources and to handle tools effectively and efficiently. As you know, by means of Network Community, such a user may obtain suitable know-how to achieve his/her purpose. He (She) can reproduce furnitures with his/her material discovered in Network Community by means of utilization of Know-How which can be also discovered in Network Community. Such a scheme is conceptually shown in Figure 7.

![Figure 7. Knowledge Discovery in Network Community.](image)

Even a beginner of design education may sometimes be brought face-to-face with some related problems and then he/she must retrieve/utilize Network Community and solve them using Such communities. In the case of reproduction of furniture as an example of design education, he/she does really reproduce furnitures with powerful supports from Network Communities. With help of good tools and suitable knowledge how to manipulate as well as timely discovered material, the relevant beginner can perform his/her duty as his/her task for design education to reproduce some kinds of furnitures.

![Figure 8. Reproducing Furniture by means of Tools and Knowledge using Obtained from Network Community.](image)

Figure 8 shows that even a beginner can reproduce furniture by means of by means of tools and knowledge discovered in Network Community. And he/she can accumulate not only all necessary techniques for tool manipulation but also knowledge about furniture reproduction through practical experience to use Network Community as well as to utilize resource, tool(s) and knowledge.

If needs are not very few, the next demands about furniture reproduction may occur potentially. Such demands are steady and continuous so that it may be necessary to prepare some market research and securement of materials which are not only unused resources but also newly created ones.

4 QUALITATIVE AND QUANTITATIVE EVALUATION

This section explains two types of evaluation, the former is based on Reproductive Design Education of Furnitures using Social Networks and the latter is based on statistical analysis.
4.1 Qualitative Evaluation for Reproduction of Furniture as Recycling Resources

As evaluation of reproduction of furnitures described above, we explain the following three items, namely cost-performance, feasibility study and human-relation based activity.

- **cost-performance:**
  Recycling of resources is positive but necessity to transport tools/resources/products is negative.
  The former is a good effect for ecology, cost-saving, and environmental protection. Resources for furnitures are almost woods so their recycling can reduce some impacts from deforestation. Recycling also brings cost-saving normally.
  The latter is a bad effect for emissions of carbon dioxide through traffic increasing and all-too-easy way of borrowing tools and know-how. Emission of carbon dioxide must increase by means of transporting resources and tools. If an imprudent person wants to participate in such Network Community, he/she frequently raises troubles based on borrowing tools and know-how in easier ways than other conventional approaches.

- **feasibility study:**
  Our viewpoint for reproduction of furnitures stands for the very best case to be performed. If some conditions are not satisfied, such reproduction cannot continue any more.
  For example, resources are necessary to be supplied in a low cost (although paying transport dues) and Network Community kindly provide know-how about relevant requests from users. In order to keep and satisfy the above conditions, we need to maintain and expand (= grown up) suitable human relation on Network Community. This may be one of most difficult problems!

- **human-relation based activity:**
  Utilization of Social networks itself must be a good idea and it can be expected to make our life styles more fruitful. Although one person does not carry out works, many persons can perform such works probabilistically. Namely, activities based on human relation will be identical to times of single person’s activity.
  It may be expected to have synergistic effect based on human relation through our practical experiences[8][9]. Anyway, it is necessary to lay out a well-suited goal to contribute to the maintenance of human relation on Social networks.

The above discussion has been limited to reproduction of furniture with recycling resources and tools/knowledge. But our concept may be applicable in other target of reproductive design education and finally (hopefully but probably) suitable in practical design education schemes.

4.2 Quantitative Evaluation by means of Statistical Analysis

We have asked five learners in reproductive design education to report their correlation between behaviors in SNS access and satisfaction level based on SNS utilization for reproductive design education. This means whether it is useful for learners to satisfy utilities of SNS for their practical reproductive design education. It is shown in Table 1.

For example, as shown in Table 1, each learner receives two types of projects and his/her maximal access times for SNS is 5 and his/her satisfaction level is expressed from 1 to 5 (1: bad, 5: very satisfied).

Table 2 shows correlation between access times of SNS by Learner and satisfaction level. We think that this may have been a trial evaluation about SNS-based reproductive design education, because the more times of SNS access
Table 1. SNS access times and Satisfaction level of learners.

<table>
<thead>
<tr>
<th>Learner ID</th>
<th>Project 1</th>
<th>Project 2</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>times*</td>
<td>level**</td>
</tr>
<tr>
<td>#01</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>#02</td>
<td>3</td>
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<td>4</td>
<td>5</td>
</tr>
<tr>
<td>#05</td>
<td>2</td>
<td>2</td>
</tr>
</tbody>
</table>

times* = SNS access time; level** = Satisfaction level.

Table 2. Correlation between SNS access times and Satisfaction level.

<table>
<thead>
<tr>
<th>access times</th>
<th>Satisfaction level</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1</td>
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<tr>
<td>1</td>
<td>0</td>
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<tr>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td>3</td>
<td>0</td>
</tr>
<tr>
<td>4</td>
<td>0</td>
</tr>
<tr>
<td>5</td>
<td>0</td>
</tr>
</tbody>
</table>

Table 3. Reduced Version of Table 2.

<table>
<thead>
<tr>
<th>access times</th>
<th>Satisfaction level</th>
<th>sum</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>2</td>
<td>2</td>
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</tr>
<tr>
<td>3</td>
<td>0</td>
<td>2</td>
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<td>0</td>
</tr>
<tr>
<td>5</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>sum</td>
<td>2</td>
<td>2</td>
</tr>
</tbody>
</table>

In order to confirm that our approach is significantly effective, we will perform chi-square ($\chi^2$)-test for Table 3 as one of statistical analysis. The procedure is demonstrated as follows:

1. Calculating $\chi^2$, namely

$$
\chi^2 = \frac{(2 - 2 \times 2/10)^2}{2 \times 2/10} + \frac{(0 - 2 \times 2/10)^2}{2 \times 2/10} + \ldots
\chi^2 = \frac{(1 - 2 \times 2/10)^2}{2 \times 2/10}
$$

2. Obtaining $\chi^2 = 15.92$

3. Degree of freedom of Table 3 is $(4 - 1) \times (4 - 1) = 9$

4. From $\chi^2$-distribution table, we can get chi-square percentile with degree-of-freedom = 9 at the 5% significance level and 10% one as follows;

$$
\chi^2_{0.05}(9) = 16.9 \text{ and } \chi^2_{0.10}(9) = 14.7,
$$

respectively.

In the above results of chi-square-testing, we can describe the following:

- If $H_{01}$: Our approach is not useful at the significance level ($\alpha = 0.05$) is a “null hypothesis”, based on expression:

$$
\chi^2 = 15.92 < \chi^2_{0.05}(9) = 16.9,
$$

at the 5% significance level, $H_{01}$ cannot be rejected.

Therefore, it can ‘not’ be confirmed that SNS-access times (namely, utilization of SNS services) are significantly dependent on obtaining satisfaction of learners at the significance level ($\alpha = 0.05$).

- However, if $H_{02}$: Our approach is not useful at the significance level ($\alpha = 0.10$) is another “null hypothesis”, based on expression:

$$
\chi^2 = 15.92 > \chi^2_{0.10}(9) = 14.7,
$$

at the 10% significance level, $H_{02}$ can be surely rejected.

So, it can be confirmed that SNS-access times (namely, utilization of SNS services) are significantly dependent in obtaining satisfaction at the significance level ($\alpha = 0.10$) in turn.
Of course, we have recognized the above result based on the difference of significance level and its influence to our quantitative evaluation. Reproductive Design Education has just only begun and it is one of challenging approaches to ecological and collaborative design. At the viewpoint of effect and efficiency, social networks and Network Community can be expected to support Reproductive Design Education by means of the above qualitative quantitative evaluation.

5 CONCLUSIONS

The paper has described the detail of recycling resource and tools for reproductive design education using Network Community. As a consequence, utilization of Resources, Tools and Knowledge(know-how), through recycling materials of furnitures for reproductive design education, results in very much important and significant values to the relevant Network Community and more over Social Network based on Internet.

With the above discussion, it can be summarized in this paper as follows:

- Reproductive Design Education has the effect of recycling, ecology and cost saving.
- Reproduction of furnitures, itself, as an example of Proposal Design Education can play a certain role of utilization of Resource and Knowledge from Network Communities.
- Reproduction and recycling with support from networks seems to be some case study of Resource and Knowledge Discovery using Network Community.
- Qualitative and quantitative evaluation have been applied and some characteristics of results are obtained in order to improve reproductive design education using SNS useful services.

As our reviewer's comment, namely, “The overall contribution is acceptable. However, if I am the author, I will go through it one more time for possible improvements and more contribution,” our near future issue about this research will be summarized as follows;

- We should apply our approach to more numbers of users in order to make sure of our strategy in the same ways.
- We must analyze those results from the above trial for justification of our approach and its feasible improvement for more suitable utilization.

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