The Analogies Theory in the Design and Application of E-Learning Material

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Abstract—Analogy has been the basic capability for us human when we apply to solve daily problems that we face throughout our lives. In the field of education, it is also viewed as one of the effective teaching tools. This thesis primarily explores the definition of analogy, the learning process of analogy in addition to utilizing the analogy learning in the applications of e-Learning teaching material design. And through the teacher’s application of analogy teaching methods, it allows the learner perform meaningful learning via e-Learning materials and gradually establish his/her own cognitive structure, alter the learner’s mental model as well as inspire the learning pleasure for the learner in the end.

Keywords—analogy; meaningful learning; cognitive structure; mental model

I. INTRODUCTION

Quality teaching material for e-Learning is the key to successful e-Learning (Chen, Ming-Pu, 2005). And the quality assessment for e-Learning teaching material can assist both the teacher in producing teaching materials and the user while selecting appropriate e-Learning teaching materials as the yardstick to measure. Hence, the structures and contents for e-Learning teaching material standard would accommodate simultaneously the evaluations through the assessment viewpoints from learner, instructor, developer as well as administrator, etc (Chen, Ming-Pu, 2005).

“Learning by analogy” can be simply put as by applying the learning contents of abstractness or complexity through the learner’s standpoint or his scope of cognition, then this approach can point out concrete illustration in the analogy and enable the learner to understand within the shortest period as possible. Just like the quotes from Mo Tzu’s Hsiao-Chu essays: “Analogy is to explain through other example”. Consequently, the old saying of “Those who can apply analogy can be the teacher” would summarize this accordingly. In the annals of science, there are plenty of examples in applying analogy so as to come up with breakthrough invention or in the research field as well. For instance: The configuration of phenyl, survival of the fittest by Darwin, and the atom’s model by Rutherford, etc, all of these utilized the analogy to acquire the critical findings. Therefore, analogy is a learning method based on existing knowledge. On one hand, it naturalizes new knowledge into the existing structure; on the other, it facilitates the creation for new cognitive structure for the learner. Henceforth, teachers frequently apply analogy reasoning to solve new problems, which can help the student construct abstract or microscopic concepts, eventually through the analogy migration to learn the new knowledge.

II. ANALYSIS OF SAMPLES ANALOGY AND E-LEARNING TEACHING MATERIAL DESIGN

Most researches on the analogy related documentations would touch base with the common grounds for both “analogy learning” and “meaningful learning”. What significant about meaningful learning really is: “Learner can be aware of the new learning contents and make connection with the old knowledge in the cognitive structure of the brain. And through learning, it internalizes them into part of the cognitive structure (Chang, Hsin-Jen, 2003)”. For instance: When students learn the lever principle, they can recollect the experience from playing the seesaw, and by applying this experience, they can relate to the identical principled lever principle.

Nonetheless, “Meaningful learning” which Ausubel referred was primarily in the sense of application for general teaching; and analogy could have happened in our lives at any time, especially in the era noted for expansive technological deployment in processing or information conversion of the modern days.

<table>
<thead>
<tr>
<th>Application domain</th>
<th>Analogy</th>
<th>Similar to</th>
</tr>
</thead>
<tbody>
<tr>
<td>OS</td>
<td>Desk top</td>
<td>Office operation, file management</td>
</tr>
<tr>
<td>Excel</td>
<td>accounting ledger</td>
<td>Digitized table</td>
</tr>
<tr>
<td>Object-oriented Environment</td>
<td>Practical world</td>
<td>Behaviors in real world</td>
</tr>
<tr>
<td>Hyperlink</td>
<td>Notes or cards</td>
<td>Flexible organization and structured words</td>
</tr>
<tr>
<td>Multimedia Environment</td>
<td>Room(each room and different medias or operation related)</td>
<td>Space constructs in the building</td>
</tr>
<tr>
<td>CAI</td>
<td>Agents</td>
<td>Knowledge of culture</td>
</tr>
</tbody>
</table>

From the table above, it is discovered that analogy has been developed in the computer interfaces as well as applied onto
Different domains. When the learners suddenly discovered: “Hum, how come the computer turns easy!”, they acquired the learning of analogy without being aware of it. The only thing about this is that, this type of learning is primarily relied upon the user interface designs from designers.

Constant technological advancement changes human living pattern as well as the things to do. We can organize people scattered around to perform group related tasks. The knowledge-based technology impacts the overall software development systems and indirectly affects the interactions between human and machine. When the computer development is getting more and more advanced, what we need is the sufficient humanization for the human machine interface, even so, the prerequisite for humanization is the discrepancy of the mind and intelligence models between the system designer and user would not be too great to overcome. See figure below (figure 1.) for details from the mind and intelligence models of the design model and user as well as exhibited image differences displayed by the system:

![Diagram](image)

Figure 1. Design model, user’s mind and intelligence

Generally speaking, the application model for e-Learning could well be the online self-learning or teaching from either online or teacher-guided. The plus and minus for these two applications can provide course planner to evaluate, nonetheless, it stresses that by adding the digital technology, it can allow the deployment of learning flow be reorganized as well as to integrate with all kinds of technologies, including synchronized tools, performance support system and learning sheet, etc. The so called relying on the goal as the foundation during design phase needs to evaluate three profiles; they are separately the teaching contents, learner, the technology and environmental profiles. And furthermore, it is to design the training courses with contents outlines and themes, planning for each theme’s teaching strategy and activity, design flow for organizational integrated teaching, design for training assessment strategy (Chang, Shu-Ping, 2006).

Currently, e-Learning teaching design uses the commonly seen ADDIE teaching design model (See figure 2.). Simplified digital teaching material development usually adopts this as its development foundation.

![Diagram](image)

Figure 2. Teaching design model for ADDIE

III. ANALOGY APPLICATION IN E-LEARNING

After understanding the importance of analogy to learning, let’s follow by exploring the analogy application on teaching and learner’s operation in the analogy learning as well as applying analogy learning to assist the learner to understand the concepts and the process of constructing cognitive structure.

A. Analogy Teaching Model

Someone says: “When new discovery and learning result with learner radiating happiness, then all the hard work and payout in teaching are well worth it.” The biggest pleasure any teacher can have is probably resulted from the complete devotion from learner and the learning itself. Therefore when
we think about how to induce the learning from the learner as well as solve problems, analogy teaching model is unequivocally solving the dilemma we face during teaching.

Figure 3. TWA analogy teaching model

The general analogy teaching normally includes the target, source and mapping. The target is the knowledge which the learner wants to know. Source is the cognitive structure or experience which the learner already possesses. Mapping is the comparison between target and source and pairing the similar portion one at a time. The following is the figure this article introduced “TWA’s analogy teaching model”, and its teaching procedures are detailed (as in figure 3).

The procedures for analogy teaching are depicted in Table 2.

<table>
<thead>
<tr>
<th>Procedure</th>
<th>Contents</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Introduce concepts to be learned</td>
<td>Appropriately illustrate the target concept</td>
</tr>
<tr>
<td>2. Awaken the concepts of analogy source</td>
<td>The source which learner familiarizes with</td>
</tr>
<tr>
<td>3. Distinguish the similarity between concepts</td>
<td>Illustrate the relevant attributes of source in analogy</td>
</tr>
<tr>
<td>4. Map similar portions</td>
<td>Illustrate the similarity between the source and target</td>
</tr>
<tr>
<td>5. Deduce the summary for earning concepts</td>
<td>Learner should be aware the difference between the source and target as well as the confusing part</td>
</tr>
<tr>
<td>6. Point out the constraints for analogy source</td>
<td>Summarize with illustration the important concept for the target</td>
</tr>
</tbody>
</table>

When teachers conduct analogy teaching, some of the abstract concepts cannot be presented in a mapping format, then they must fall back on appropriate analogies for proper illustration so as to let the learners accept as well as construct the cognitive structure.

B. General Teaching of For...Next

1) Flow chart:

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C. Analogy Teaching of For...Next

In the “For...Next” loop, it contains the descriptive which can be any, of course it can also be another descriptive of For...Next, only that this would turn into the so called “Nested Loop”, which is also formed by more than two For...Next. Since there are more than two For...Next, this would confuse learner with the execution sequence. Then the key is that it requires teacher with adequate explanation and illustration so as to help learner clarify the abstract concept.
Now we adopt three “For…Next” as example as depicted in figure 5. By applying the clock (Hour, Minute and Second hands) as the analogy sources, let learner understand the execution sequence of For Next in “Nested loop”.

Example code:

```vbnet
Private Sub Form_Activate()
    Print “print time”
    For A = 1 To 1
        For B = 0 To 59
            For C = 0 To 59
                Print A; “ : “; B; “ : “; C
            Next C
        Next B
    Next A
End Sub
```

Figure 5. Image of For Next analogy teaching and its execution

In the above example, we adopt the inner most loop as “Second hand”, the second-layered loop as “Minute hand” and the third-layered loop as “Hour hand”, then the whole program operation is like the operation of clock. Learner would immediately learn which of the For..Next would be executed first within “Nested loop”. At this point, this author tries to apply the analogy thinking model mentioned in the cognitive-historical analysis of Nersessian (1992) to display the process for constructing the cognitive structure through analogy learning for the learner in figure 5.

IV. CONCLUSIONS

No learning method or teaching method is perfect, and from the analogy related documentation, we are aware that someone even treats this analogy as “Two edged sword”, if properly used, it can be powerful in a positive sense, if not, it goes without saying.

Therefore, analogy plays a vital role in the sense of both the scientific invention and communication. Thus, it should allow learners under the assistance of e-Learning materials proceed gradually via interactive ways to understand the new concepts. Since analogy is the bridge between the known and unknown, therefore the teacher during teaching should be both expressive and analogous in style and use all kinds of concrete and simulated teaching materials which learners can identify with so as to facilitate learning of new concepts. Consequently in the future, while teachers are proceeding to having the analogy theory infused into e-Learning teaching materials, the following are the checklists:

1. When start from the similar relationship between the analogy source and target, it should approach based on the knowledge of characteristics and regular pattern from one side to deduce those from the other side.
2. The lesser the commonalities between the analogy sources, the more far apart the connectivity would be, and the analogy conclusion would be more like having the break-through quality and uniqueness as well.
3. When conduct analogy teaching, it is to first design the cognitive environment conducive to learner’s understanding and be conscious of the fact whether learner possesses the so called “prerequisite constraints”.

Figure 6. Process of constructing abstract cognitive structure
knowledge”.

REFERENCES


