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# Study of 3C-HEAT Integration Levels in Chinese ICT Lesson Plans

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**Abstract:** Critical Thinking, Creative Thinking, and Collaboration (3C) are the three important factors of 21<sup>st</sup> century skills. In Maxwell's HEAT (Higher-order thinking, Engagement, Authenticity and Technology) instrument, High-order Thinking implies Critical Thinking & Creative Thinking, while Engagement involves Collaboration. However, her results do not show 3Cs' integration levels in lesson plans clearly. Therefore, the purposes of this study are to (a) investigate 3Cs' integration levels in lesson plans, and (b) analyze these three factors' correlations with their respective related factors. We have designed corresponding levels of 3C combining 7 levels (0-6) of HEAT, and analyzed 26 pieces of lesson plans gathered from advanced ICT teachers in high school in Shanghai, China. The findings show that (a) the integration levels of Authentic learning and Technology were low though ICT has close relationship with them; (b) compared with Creative Thinking, teachers were skilled at integrating Critical Thinking into their instruction; (3) the integration levels of Collaboration was low due to monotonous collaborative methods. In order to find out the integration details of 3C in each lesson plan, we selected 12 higher-score activities. We found that most teachers preferred design outreach activities to develop students' abilities and that the categories of instructional strategies were limited.

**Key words:** 21<sup>st</sup> Century Skills, Critical Thinking, Creative Thinking, Collaboration, Higher-order Thinking, Engagement

## **INTRODUCTION**

How students learn is always being focused on and argued by educators. That's because what students should be equipped is always changing with the social development. In the 21<sup>st</sup> century, society needs students to master skills that help to increase their competitive power. The partnership for 21<sup>st</sup> century skills (2009) summarized 21<sup>st</sup> century learning skills into critical thinking, creative thinking, collaboration, and communication. Many active learning instructional strategies have been proven to cultivate 21<sup>st</sup> century skills effectively. However, Chinese middle and high school ICT teachers, have difficulty using these instructional strategies flexibly in their classes.

Higher-order thinking, engagement, authenticity, and technology (HEAT) are accepted as four important factors to promote student's active learning. High integration levels of HEAT in learning are educators' goals. Because a lesson plan can describe and reflect a teacher's instructional strategies and procedures in detail, analyzing teachers' lesson plans is a good way to investigate integration levels of HEAT. Some researchers have developed assessment standards for each component of (Margaret Maxwell et al, 2011).

Our final objective is to cultivate students' 21<sup>st</sup> century skills through Chinese ICT teachers in their classes. In addition to HEAT components, we also focused on investigating the integration levels of 21<sup>st</sup> century skills - critical thinking skill, creative thinking skill, and collaboration skill (3C), respectively.

## **PURPOSES OF THIS STUDY**

The two purposes of this study are to:

1. Measure the integration level of 3C-HEAT in current lesson plans by using the 3CHEAT instrument.
2. Find out integration details of 3C in higher-score lesson plans.

## **RUBRIC DESIGN**

In this study, we used an assessment rubric - 3CHEAT instrument - to score each component's integration levels in gathered lesson plans. There are 7 levels (0 - 6) in the instrument, and a score of 0 to 6 assigned to each. Level 0 scores 0, which means there is no component used in lesson plans. From level 1 to level 6, the integration level increases gradually to incorporate awareness, application, exploration, integration, expansion, and refinement components in sequence. Level 3 is the basic level. The 3CHEAT instrument is composed of two parts. One part is the HEAT instrument designed by Margaret Maxwell et al. (2011), and the other one is the 3C instrument designed by the researchers.

### **3C rubric**

We designed each 3Cs' level based on the corresponding level of Margaret's HEAT and its own essential characters. Higher-order thinking of HEAT instrument is related to critical thinking and creative thinking, so, to some degree, their levels should correspond. For example, the awareness level of higher-order thinking is "students are learning at the knowledge level of Bloom's Taxonomy". Correspondingly, the awareness of critical thinking is in that "students judge based on a single concrete knowledge" and the awareness of creative thinking contains "students think outside their knowledge".

## **DATA COLLECTION**

### **The course**

We chose ICT as the course of our research. The first reason for choosing ICT over other subjects is that high school ICT course's educational goal is to cultivate and promote students' information literacy. The United States National Forum on Information Literacy defines information literacy as "— the ability to know when there is a need for information, to be able to identify, locate, evaluate, and effectively use that information for the issue or problem at hand." The requirement of cultivating ability asks for teachers to focus on integrating 21<sup>st</sup> century skills into instruction. Secondly, ICT course contents are related to the real life which contributes to use the authentic learning in the classroom. In addition, academic pressure on ICT teachers is not as heavy as that of major courses.

### **Study object**

We determined to analyze lesson plans of teachers in Shanghai. That is because Shanghai is one of the most advanced provinces in teaching ICT in China.

## **RESULTS & DISCUSSION**

Table 1 shows frequencies and percentages of 3CHEAT components. In our study, levels under level 3 are considered unfavorable, and those above it (including it) are targets we want to meet.

From table 1, we found that each component's mean, except that of critical thinking and higher-order thinking, was lower than the basic level - 3. The lowest two means belonged to collaboration and technology. For percentages, we cared about the meeting target percentage. In HEAT components, higher-order thinking was the highest scoring component, a result similar to that found in Margaret Maxwell's research (97%). Except for higher-order thinking, the target percentages of the other three components were far lower than those found in Margaret

Maxwell's research(91%, 82%, 94%), especially– those of authentic learning and technology. Technology integration reached the target in only 23.1% lesson plans, even though ICT has a close relationship with technology.

Table 1: Frequencies and percentages of 3CHEAT components (N=26)

| 3CHEAT level    | 21 <sup>st</sup> century skills |             |               | Higher-order thinking | Engagement  | Authentic learning | Technology  |
|-----------------|---------------------------------|-------------|---------------|-----------------------|-------------|--------------------|-------------|
|                 | Critical T                      | Creative T  | Collaboration |                       |             |                    |             |
| 0-2             | 2<br>7.7%                       | 13<br>50%   | 17<br>65.4%   | 2<br>7.7%             | 10<br>38.5% | 14<br>53.9%        | 20<br>76.9% |
| 3               | 18<br>69.2%                     | 10<br>38.5% | 7<br>26.9%    | 17<br>65.4%           | 10<br>38.5% | 9<br>34.6%         | 2<br>7.7%   |
| 4               | 6<br>23.1%                      | 3<br>11.5%  | 2<br>7.7%     | 7<br>26.9%            | 6<br>23.1%  | 3<br>11.5%         | 4<br>15.4%  |
| 5-6             | 0                               | 0           | 0             | 0                     | 0           | 0                  | 0           |
| Meeting target* | 24<br>92.3%                     | 13<br>50%   | 9<br>34.6%    | 24<br>92.3%           | 16<br>61.6% | 12<br>46.1%        | 6<br>23.1%  |
| Mean            | 3.08                            | 2.42        | 2.04          | 3.12                  | 2.77        | 2.23               | 2           |

\*i.e. scoring at level 3 or above

In 3C components, critical thinking reached the target in 92.3% lesson plans- which ranked first. Creative thinking reached the target in only half lesson plans. We concluded that, compared with critical thinking, ICT teachers in Shanghai were not good at integrating creative thinking in their classes. Lesson plans in which collaboration reached the target level accounted for just 34.6%.

In fact, one lesson plan is combined with several activities. From beginning to end, they can be classified into lead-in activity, instructional activity, outreach activity, and evaluation activity. These activities are not linear and integral, so some lesson plans may contain two or three of them. Each activity has its 3CHEAT levels. In the analysis above, we scored each component of a lesson plan by the highest score of all activities. This scoring method could not display the details of 3C. Therefore, we selected 12 higher-score activities from 11 lesson plans whose means are higher than the overall mean to analyze 3C. Table 2 displays the result.

Table 2: 3C methods of higher- score activities (N=12)

| No. | Critical T | Creative T | Collaboration   | No.  | Critical T | Creative T | Collaboration   |
|-----|------------|------------|-----------------|------|------------|------------|-----------------|
| A1* | Task       | Task       |                 | A7*  | Task       | Task       | Free discussion |
| A2* | Question   | Task       | Peer discussion | A8*  | Task       | Task       |                 |
| A3* | Problem    | Problem    |                 | A9*  | Question   | Question   | Free discussion |
| A4* | Task       | Task       | Group working   | A10* | Task       | Task       | Group working   |
| A5* | Question   |            | Competing       | A11* | Evaluation | Evaluation | Free discussion |
| A6* | Task       | Task       | Free discussion | A12* | Evaluation | Evaluation | Free discussion |

\*i.e. outreach activity; \*i.e. instructional activity; \*i.e. evaluation activity

In these 12 activities, half belonged to the outreach activity, which was held to promote students' abilities at the end of instruction. This implied that most teachers were more accustomed to designing special outreach activities to develop students' abilities, rather than integrating skill cultivation into the instructional process. Teachers were familiar with using tasks, problems, and questions to stimulate students' critical and creative thinking. Most tasks, problems and questions were close-ended. This type of organization belongs to skill application rather than skill cultivation. In addition, methods of collaboration were confined to free discussion which is unorganized and in which it is hard to ensure most/all students' participation. This could explain why collaboration scored low.

Therefore, in order to cultivate students' skills, our future research needs to focus on increasing integration levels of 3CHEAT and to conceive of how to transform the organization format to cultivate 21<sup>st</sup> century skills.

## CONCLUSION

The integration levels of 3C-HEAT in current high school ICT lesson plans were not satisfied. We also found out the activity categories, instructional strategies, and collaborative methods which are often used to stimulate students' 3C skills by ICT teachers in Shanghai. These details provide us an important background to cultivate 21<sup>st</sup> century skills for future research.

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