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A Study of Developing the Technology Creativity Scale Suitable for Junior High School
Teachers - The Case of Taichung Municipal
Junior High School Teachers

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Abstract

The aim of this study is to develop a feasible technology creativity scale for the junior high school teachers and to provide a research tool for researchers in the related field. Based on the divergent thinking test, the researcher integrated the knowledge in technology field, thinking procedure, and results to develop the scale with the consideration of the product-oriented concept. The content of the scale includes three dimensions: creative thinking, creative skill, and creative inclination. Among them, the items of creative thinking and creative skill are of non-structure design, while those of creative inclination are of structure design. The Technology Creativity Scale is done through empirical research. Its feasibility is confirmed empirically and can be used in a large-scale research.

Keywords: Creativity Ability, Technology Creativity, Technology Creativity Scale

Introduction

Research Background and Motivation

In the twenty-first century, human beings' technology development is too rapid to predict its next step. Human beings' belongings of daily life all are the products of technology. One of the basic capacities necessary for design and invention is creativity. Creativity is considered as a very abstract term. A number of scholars in different countries stated a variety of definitions of assessing creativity. For example, divergent thinking test, personality scale, attitude, and interest scale, others' assessment, biography-like asking and answering, outstanding people's avowal creativity activities and achievement, and products evaluation. These methods' feasibility is confirmed through empirical studies.

Recently, some scholars extended the field of the research and tried to develop a scale of combining professional field. The development of test of technology creativity is one example. The unique technology creativity test was developed by Yeh (2005). However, the proper subjects are limited to the students of 3 to 6 grades students in elementary schools.

Consequently, the related researches of this field are lack of proper research tools. To meet the need of the studies of technology creativity, the researcher of this study developed one suitable research tool to analyze technology creativity of junior high school teachers.

Objective of this Study

Based on the motivation and background of the research, the objective of this research is to develop one technology creativity scale for junior high school teachers.

Literature Review

The Theoretic Basis of Creativity

Creativity is a very abstract and complicated issue. In 1959, Guilford used factor analysis to do the related study. And he found that creativity includes fluency, flexibility, uniqueness, and exactitude (Yeh, 2004). The related research has been conducted by numerous researchers in behavior science field and education field. The results are rather abundant. Especially in recent years, plentiful professional books were published. And some integrated theories have replaced the partial or incomplete research findings and discussion. Two phenomena are worth of mentioning. One is that applicative and empirical studies are gradually replacing the conventional theoretic or conceptual studies. The other is that the academician scholars' discussions about the creativity of human beings are promoted from the general dimension to a domain specific product-oriented application (Yeh, Wu, and Zheng, 2000).

Although the dimension of the studies about creativity have been promoted from general and conceptual sphere, it is still necessary to illustrate the basic theories and definitions of creativity. The definitions of creativity are different from one school to another. Yeh (2000) defined creativity as an individual's procedure to generate a product with originality and value in a specific field. The procedure includes the integration and efficient application of cognition, skills, and affection. It means that creative performance is the result of the interaction among individual's knowledge, intention, skills, and the environments of organizations. This belongs to the definition of application dimension.

The Assessment of Creativity

The scholars whose professional field is the research of creativity commonly use the following eight methods to access creativity: 1. test of divergent thinking, 2. personality inventories, 3. attitude and interest scale, 4. others' evaluation, 5. the Q and A in biography, 6. eminence, 7. self reported creative activities, 8. judgments of products.

The creativity assessment methods, and assessment tools in Taiwan, and the scoring index of creativity assessment are illustrated as following.

1. Methods to assess creativity

There are various types of methods to assess creativity. Some Taiwanese scholars (Lin, 2002; Chang, 2003; Chen, 2006) argued that the most widely-used methods are the eight main categories stated by Hocevar (1981), and Hocevar & Bachelor (1988).

(1) Test of divergent thinking

It was developed according to the divergent thinking principle of the cognition operation dimension in intelligence structure theory.

Guildford and his co-worker developed many tests of divergent thinking. Among these tests, they use divergent thinking (D) to deal with the materials such as figure (F), symbolic (S), Semantic (M), and Behavior (B). They get the results such as units (U), classes (C), systems (S), transformations (T), and Implications (I). There are 24 combinations of results. For example, in DMT, namely Divergent Semantic Thinking Test: a subject would be asked to make a title for an interesting story. The story is that a person who ate the fish he had got and by this he lost a chance of winning a prize (Chen, 1984).

Torrance creative thinking test is usually employed to assess flexibility, fluency, originality, and elaboration. Besides, Creativity Thinking Activities (Lin & Wang, 1984) and New Creative Thinking Test (Wu, 1998) in Williams Creativity Test.

(2) Personality Inventories

The most widely-used tools are biography-like self-report scale, or psychology assessment tools which are lack of structure, such as reflection test, or the psychology

assessment tools with structure, such as California Psychology Scale. Adjective check-tables are sometimes used to assess creativity.

The Test of Divergent Thinking is to assess the inventories of cognition dimension. In fact, personality inventories have significant influence to creativity performance. Therefore, in the assessment, the personality inventories related to creativity (like independence, openness, imagination) can be used to infer the degree of the creativity of the examinees (Mao, 2001).

Torrance categorized 84 kinds of personality characteristics of the person of creativity. Among them 34 personality characteristics are the most significant (Kuo, 1992). They are accepting chaos, having adventure spirit, caring about others, passion, always feeling confused, being attracted by chaos, being attracted by mysterious things, being shy, constructive critical thinking, being responsible, being free from the restriction of the manners, owning super wishes, being sensitive to differences of values, being confused buy institutions, being very emotional, being hard in dealing with others, being free from the fear of being different from others, enjoying staying alone, doing judgment alone, irregular life style, never feeling tired, keeping asking questions, being a little wild, feeling exited about different ideas, being confident, owning sense of responsibility, being humorous, keeping away from power, being true, being automatic, being stubborn, sometimes shrinking, having imagination, being very talented.

(3) Attitude & Interest Inventories

Based on researches, people of creativity would show the attitude and interest positive for creative thinking activities. For example, the items in Pennsylvania Assessment of Creative Tendency developed by Raokey (1977) represent the living attitude and opinions about things. The examinees can answer according to the degree of their agreement. According to Mao (2001), scales of similar function are creativity tendency scale (Lin & Wang, 1987) in Williams' (1980)

Creativity Assessment Racket (CAP), Raudsepp's Creative Scale (Ding, 1991), Creative Perception Inventory developed by Khatena & Torrance (1976), and Group Inventory for Finding Interests (GIFFI) developed by Davis and Rimm.

(4) Teacher Nomination

Teachers generalize judgment criteria of behavior characteristics. They use the criteria to nominate the students of creativity characteristics.

(5) Peer Nomination

Provide some criteria for peer nomination, such as who have the most discourse, whose ideas are always the best. Ask students to nominate.

(6) Biography Inventories

From the description of the past experience, the creativity of the examinees can also be evaluated. Some questionnaires are usually designed for the examinees to fill in. The items of the questionnaires include personal experience, home's environment, and school's environment. One of the examples of this type is Alpha Biography Inventory designed by Taylor and biography inventory designed by Schaefer.

(7) Eminence

The eminence of identification can also be taken as criteria of evaluation. The investigation of outstanding peoples' characteristics can be used as the index of creativity.

(8) Self Reported Creative Activities & Achievements

The most convenient way to judge an individual's creativity is judging one's activities and achievements. For example, patents, public exhibition of personal works, the honor of science exhibition race, the literature works published in national newspaper, novels, and the drama performance. Holland has conducted considerable studies about this method of assessment

of creativity. Hocevar (1979) used to employ empirical methods to organize an assessment questionnaire according to the creative activities and achievement mentioned above. It can evaluate a person's creativity in art, technical, literature, music, drama, and mathematics-science dimensions. The user of it can check the frequency of a person's characteristics' matching the items. The frequency represents the degree of a person's creativity. In addition, Torrance (1969) and Runco (1986) also took similar check-table lists as the basis of evaluation. Lin (2002) argued that people can not judge what kind of activities and achievements can be seen as creative ones with ease, but its surface validity is rather high.

(9) Judgments of Products

This assessing method is different from other types mentioned above; some scholars considered that the products developed by individuals are the most direct basis to judge the degree of creativity. Those who judge products can be the experts of the professions, and can be general people. Different criteria of judgment can be made by different definitions of creativity (Lin, 2002).

The international indices of creativity of products include originality, practicality, and advancement of products.

(10) Supervisor Ratings

In industries, this method is always employed to select the employees with potential to receive advanced training.

Research Methodology

The Theoretic Basis of Technology Creativity

In the age of technology, the products are always updated very rapidly. The commodities used in our lives all belong to the products of technology. The design and invention of technology products require creativity, namely, the power of technological creativity. Hong (2006) stated that the definition of technology creativity is imitation, application, and innovation in the process of technology creation. Basically, imitation is not empirical. It can not belong to technology creation. On the contrast, the application and innovation must be empirical. The creation of technology can be seen from the dimensions of knowledge, empirical behavior, and experimental fabrication. Genuine creation of technology must match these three dimensions to some degree.

What can be called as the core abilities of technology creativity? Hong (2006) stated objective technology creativity and subjective technology creativity as the core abilities of technology creativity. Objective technology creativity refers to judge the technology creativity based on the product-oriented viewpoints. The cores are knowledge, the ease of making hypothesis, and the experience of experimental fabrication. Subjective technology creativity refers to an individual's ability to analyze, to think, to criticize, and to realize. The necessary characteristics are as follow.

The Assessment of Technology Creativity

The scholars who are dedicated in doing the research of technology creativity include Yeh Yu-zhu, who began the studies about creativity realization procedure. Later, Sun, Chun-zai, Yuan, Xian-ming also have considerable contribution of the studies of technology creativity.

Yeh Yu-zhu's technology creativity test is suitable to the third to sixth grades elementary school. Her test method includes individual test and group test. Lee, Da-wei's (2000) Scale of Technique Creativity also employs Yeh Yu-zhu's.

The Development of Technology Creativity Scale

The scale is based on the divergent thinking test. The technology knowledge, thinking process, and results are integrated in it. It is developed through the product-oriented concept.

The Content of the Scale

The scale includes three dimensions: two are of none-structural design, while one is of structural design.

(1) Creative Thinking: new combinations of the technology device used in daily lives. Show creativity by the combination of two or more technology devices.

(2) Creative Skills: inventing one kind of creative remote control. Include drawing the picture of the remote control, inventing its name, illustrating its characteristics and functions.

(3) Creative Inclination: including 33 inventories.

2. The Filling and Scoring of the Scale

(1) The first part, basic data, refers to the personal background of the subjects.

(2) The second part, scale content, includes the first and the second dimensions. The examinees are asked to write the combination's characteristics, name, and illustration according to their observation, cognition and imagination for the first and second dimensions. As for the third dimension, the examinees are asked to choose the proper items from the figures representing always do, usually do, sometimes do, seldom do, and never do.

(3) Scoring methods:

In the first dimension, one combination of creativity is given one point. The more the examinee writes, the more points he or she gets. There is no limit of the scores.

In the second, the drawing of the picture is given five points, one point of one characteristic. And one point is given to one illustration. The more the examinee writes, the more points he or she gets.

In the third dimension, the scoring is done by using R. A. Likert's scoring methods.

(4) The Validity and Reliability of the Scale

a. The subjects of the test: 100 male teachers and 100 female teachers in Taichung municipal junior high schools were chosen as the subjects by purposive sampling in this study. The number of the sample is 200.

b. The validity of the scale: with good validity of experts.

c. The reliability of the scale: The reliability of the two dimensions, creative thinking and creative skills, is between .995 and 1.000. The creative inclination dimension's Cronbach reliability is .916.

Conclusions and Suggestions

The aim of the study is to develop technology creativity scale which is suitable for junior high school teachers. After the initial study development, the scale is proved to be feasible for related studies. Furthermore, the scale can be used for the related studies of larger subjects.

The application of none-structured design (open design) was used in the creative thinking dimension and creative skills dimension. Structured design (closed design) is used in the creative inclination dimension. However, it is suggested that researchers of further studies can adjust the modes of structures of inventories to meet the actual needs of the studies.

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