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## Inspiring and Investigating Imaginative Capability of Design College Student

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**Abstract:** *One's imaginative capability will influence his/her design idea and final product, therefore the imaginative capability is important to a designer. People always considered that the imaginative capability is natural endowment; however, the authors considered that it could be inspired by the family and school education. The purpose of this research was to find a feasible way to inspire students' imaginative capability, and investigate the relationship between the students' imaginative capability to their family education and school education respectively through a devised experimental teaching. For this purpose, some reasonable influential factors of imaginative capability were selected by references and experts' suggestions, and then classified into three facets. The facets were personality, study atmosphere, and imaginal thinking respectively. The experimental teaching proved that the imaginative capability indeed can be raised by acquired education.*

**Keywords:** *Imagination, imaginative capability, design.*

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## **Introduction**

Imagination is an important element in college-level design courses. Imagination used to be regarded as innate, but many researchers have pointed out that it can be cultivated and enhanced by education (Fettes & Judson, 2010; Fink, 1976; Lindstrand, 2010).

In Taiwan, college-level design courses for imagination development are very limited. As a result, core design courses play a significant role on improving students' imagination. Conventionally, core design courses have the following features: long lecture hours, multiple instructors, pluralistic student projects, and subjective evaluation by instructors. This type of courses is conducted by having students work either in groups or individually for design projects while instructors give guidance and evaluates the outcomes. Therefore, when developing imagination-related teaching strategies, the aforementioned features of core courses have to be incorporated into the courses, and follow-ups should be carried out. The aim of this study is to investigate issues related to imagination development in college education.

The study subjects were design-major college students and college design instructors in Taiwan, and the study was conducted using experimental teaching. The first step was to design a supplementary teaching material and to integrate the material into the lectures for improving students' imagination. The second step was to develop an instructor questionnaire for investigating grading preferences of the instructors. The last step was to acquire information related to students' background and to assess the association between instructor grading and learning performance, social skills, and family atmosphere of students. The objectives of this study are described below:

- Establishing imagination grading factors: These factors were determined from the instructor questionnaire, which would be filled out by the instructors and used to determining their grading preference.
- Establishing the student questionnaire: The student questionnaire was developed for investigating three aspects related to students: learning performance, social skills and family atmosphere. The aim is to investigate whether these three aspects are associated with instructor grading.
- Finding association between students' imagination performance at the initial development stage and their final grades given by the instructors was investigated.
- Finding association between student gender and instructor grading and possible causes were investigated.

## **Related researches**

IERG considered that imagination is generated in the brain through affective activities and is closely linked to brain functions. Imagination and rationality do not contradict each other. Instead, imagination enriches our rational thinking.

Singer & Singer (2005) considered that imagination is a formal feature illustrating the capacity of an individual for reproducing images or concepts derived from basic senses. Trotman (2006) divided the context of imagination into six types of behavior (Solitary Imagination, Contemplative Imagination, Imaginative Correspondence, Contributory Imagination, Imagination Dissonance, and Reciprocal Collective Imagination) and considered that they are interlinked with each other.

Passmore (2007) explained the differences between imagination and fantasy. First, imagination is about the mind at work. Imagination is a work and is purposive, and it is about putting effort into cultivating a possible but a not yet realized project based on the interests of problem-solving, comprehension, or creation. Fantasy, on the other hand, is the mind at play. It is about actions unrestricted by any purpose or demand. Aside from their different purposes, imagination and fantasy are alike and are difficult to be differentiated. Beghetto (2008) conducted a survey on teachers' role and viewpoints on imagination thinking in K-12 education. He considered that imagination and memory process are complementary to each other.

Cheng *et al.* (2010) used a mixed design of pretest and posttest approach to evaluate the effect of associative teaching on students' poetry creation. The research tool that Cheng and his colleagues adopted to test creativity thinking is a language scale. These researchers considered that a well-designed creativity training could improve students' divergent thinking and problem-solving skills. Canadian education philosopher Egan (2010) proposed an in-depth learning approach called Imaginative. He thought that this approach should be used to replace some exams adopted by the current education system. He also pointed out that what education reform really needs is to elicit students' learning interest and to inspire their imagination.

## **Method and tools**

### *Method*

For finding a feasible way to inspire students' imaginative capability, and investigating the relationship between the students' imaginative capability to their family education and school education respectively, a devised experimental teaching is necessary in this research. Further, for supporting the experimental teaching with no interference, three tools were developed and introduced into the in the teaching. The first one is a supplementary teaching material for inspiring imagination, and it was used to help students improve their imaginative capability in the core design course. The second one is an instructor questionnaire, and the purpose is to investigate preferences of each instructor at grading and to understand whether they prefer students with good imagination development. The third one is a student questionnaire, which was focused on their learning performance, social skills, and family atmosphere.

### *Tool A: Teaching material for inspiring imagination*

The proposed supplementary teaching material for enhancing imagination included comments from design instructors of other schools. Consensus was reached that the supplementary teaching material should be presented as a picture album for the experimental group to write in and to use in the class. The content of the teaching material and the procedures were designed based on general design courses. Honestly, we did not entirely change the current teaching mode; we just used a picture album, which was developed based on traditional teaching mode, to give the students some clues for inspiration and record students' imaginative thinking progress. The teaching material is composed of weekly worksheets, and no extra burden would be added to the students. The worksheets and their corresponding procedures were designed to harmony with the course progress. They are: A. Site investigation, B. imagination of Image, C. imagination of Scene, D. imagination of Product, E. Team discussion, F.

Incubation for Concept, G. Concept concretion, H. Drawing for image design, I. Drawing for scene design, J. Drawing for product design), and K. Final exhibition.

### *Tool B: Instructor questionnaire*

The instructor questionnaire was used to investigate grading preferences of the three instructors (coded as Instructor A, B, and C) teaching the experimental course. The goal is to investigate whether instructors' final grading can be influenced by the initial stage of imagination of students. This questionnaire was developed in accordance with the principle that experimental teaching courses have to have a design imagination development stage that lasts for at least three weeks. Moreover, during the first three weeks, procedure A to G of the supplementary teaching material has to be carried out. According to the progress of the experimental teaching, the grading aspect of imaginal thinking was formulated for the questionnaire. This research asked comments from experts in the design educational or psychological field. After discussing with these experts, fifteen imagination grading factors and the corresponding questions with Likert 5-point scale were established for the grading aspect.

### *Tool C: Student questionnaire*

The student questionnaire covers the aspect of personality traits and learning atmosphere. Questions in the student questionnaire were formulated based on information collected from published imagination-related or creativity-related research achievements (Sorry there are over 6 references including international and Taiwanese research achievements therefore no citation here for saving the article size). According to the progress of the experimental teaching, two grading aspects were formulated for the questionnaire: personality and study atmosphere. This research asked comments from experts in the design educational or psychological field. After discussing with these experts, ten imagination grading factors and the corresponding questions with Likert 5-point scale were established for each of the two grading aspects.

## **Experimental teaching**

### *Process*

Because influences on imagination were divided into personality, study atmosphere and imaginal thinking, and the collection of questionnaire were from the instructors and students, therefore the questionnaire survey was conducted in two stages. At the first stage, the supplementary teaching material was offered to students from the experimental group for elevating their imaginative thinking capacity, and the instructors evaluated all the students. This was used to observe variation in students' imagination and to record their imaginative thinking process. Next, the students were asked to fill in the student questionnaire after the last lesson of the experimental teaching. The purpose of this is to understand impacts from personality traits and learning atmosphere on imagination as well as students' learning requirement based on their learning condition and environment.

### *Participants and curriculum*

The participants in this experimental teaching were all students in their junior year at the Department of Creative Design of National Yunlin University of Science and

Technology (DCD of YunTech). For integrating industrial design, visual design, and architectural/spatial design, the students in this department come from a variety of different school admission background.

The experimental teaching was conducted between 24 April 2010 and 22 June 2010. The curriculum selected for this experimental teaching was "Integrative Design for Creative Living II," which was the core design curriculum of that semester. The curriculum topic "Integrative Design for Flexible Adoption of Unused Space and Innovative Product Marketing," which expected the students to present their imaginative achievements focused on carrying out space renovation in coordination with the development of peripheral products for innovative marketing, *i.e.* the students were assigned to establish a brand-new-shop project. There were a total of 63 students (49 Females and 14 Males) in this curriculum, and they were divided into 3 clusters comprising 20 groups. Restricted within the real teaching process, one cluster is assigned for challenge to the YunTech's art centre and the others are to the Hsingchi Memorial Hall at Touliu, Yunlin County, Taiwan. Every cluster was led by one teacher. Each cluster has 3 experimental groups and 3-4 control groups depending on the use of supplementary teaching materials in the curriculum.

### *Result and discussion of teaching experiment*

Because of the pluralistic university entrance approach that is currently implemented in Taiwan, students admitted into the school where the research took place came from both general high schools and vocational high schools in metropolitan and rural areas. In the face of such variety, how can course instructors, who must teach the course as well as judging the students, tutor the students justly on their imaginal work? How can they conduct a teaching evaluation that helps them to find out from the class identify those students in their classes who possess high imaginative capability? The investigation described herein was designed to answer these questions; moreover, it is hoped that the answers can be used as a preliminary reference for teachers who wish to improve their teaching later on. In addition to inspiration for students' imagination, the research was conducted with the following questions:

- Does the presently used judge manner of design course require modification?
- Do students' imaginative capabilities have an effect on the grade of their final works?

The discussion on these questions is presented below.

#### DOES THE PRESENTLY USED JUDGE MANNER OF COURSE REQUIRE MODIFICATION?

To evaluate the effectiveness of the experimental teaching, outside judges from were invited to participate in an evaluation; the number of the inner judges was equal to the number of inner judges. The evaluation was carried out to investigate evaluation done by different instructors and to explore ways to make the evaluation more objective and fair.

First, the students were divided into an experimental group and a control group (*i.e.* the students who used supplementary teaching material and who used no supplementary teaching material). There were a total of six judges (referred to as judge A to F; judge A, B and C were the inner judges, *i.e.* the course instructors; whereas judges D, E and F were outside DCD of YunTech), and each graded the student's final work. The obtained scores for the experimental group and the control group were analysed using the student's t-test. Next, the scores were

classified into the inner judges vs. the other outside judges, depending on which judges gave the score, and analysed using the student's t-test (see Table 1 for results).

As Table 1 shows, the scores given by the judges ranged between 85.6 and 93.82. The judge F gave the highest average scores, whereas the judge B in gave the lowest average scores. The scores given by the judge F varied significantly ( $p = 0.008$ , less than 0.05), while scores given by the other judges did not. One possibility for this is that when the students were presenting their works, a lively and vivacious atmosphere minimized the variation. For this item, all the judges gave the experimental groups higher scores, indicating that the inner judges and the outside judges hared a consistent viewpoint.

**Table 1.** Data analysis of judgements of experimental vs. control groups by different judges.

Judges	Groups	Student Amount	Avg.	Std	t-test	
					t	Signification p
A <sup>#</sup>	Experimental groups	28	90.00	4.497	0.337	0.738
	Control groups	35	89.66	3.316		
B <sup>#</sup>	Experimental groups	28	87.00	3.868	1.067	0.291
	Control groups	35	85.60	6.450		
C <sup>#</sup>	Experimental groups	28	90.18	2.957	1.578	0.121
	Control groups	35	88.14	6.878		
D <sup>#</sup>	Experimental groups	28	89.71	3.660	0.362	0.718
	Control groups	35	89.11	8.116		
E <sup>#</sup>	Experimental groups	28	87.96	5.948	1.530	0.133
	Control groups	35	86.00	3.670		
F <sup>#</sup>	Experimental groups	28	93.82	3.560	2.384	0.020*
	Control groups	35	91.51	4.010		

Note: <sup>#</sup> Judge A, B and C are also course instructor A, B and C, whereas judge D, E and F are outside DCD of YunTech.

\* denotes a significant difference.

As Table 2 illustrates, the average score given by the two groups of the judges ranged between 263.40 and 271.50. Scores given by the outside judges were generally higher than those given by the inner judges, but the difference was not found to be statistically significant. In other words, inviting the outside judges from did not significantly affect the judgement for students' final works. However, because this experimental teaching session was conducted only once, it is not possible to guarantee that the judges were consistently fair; therefore, this may not be applicable to future sessions. To normalize the experiment, the authors suggest that, while it is valuable to have the inner judges (course instructors) judge the students when tutoring individuals, at the end, the outside judges should be invited to join the judgement. By doing so, the judgement will cover more aspects, and grading will be more fair and with a broader scope.

**Table 2.** Data analysis of inner judges' and outside judges' judgements on experimental vs. control groups.

Judges	Groups	Students	Avg.	Std	t-test	
					t	Signification p
Inner Judges (A,B and C)	Experimental groups	28	267.18	10.180	1.153	0.253
	Control groups	35	263.40	14.749		
Outside Judges (D, E and F)	Experimental groups	28	271.50	11.442	1.530	0.131
	Control groups	35	266.63	13.379		

**DO STUDENTS' IMAGINATIVE CAPABILITIES HAVE ANY EFFECT ON THE GRADE OF THEIR FINAL WORKS?**

There are many factors that affect the quality of design-major students' final works. For example, imagination elicited during conceptual thinking, model making skills, 2D layout arrangement, ability to use 3D drawing software, and presentation style can all affect the project evaluation. To investigate whether students' imaginative capabilities have impact on the score of the judgments for students' final works, Pearson's product-moment correlation was employed to analyze the three imagination aspects as well as the influential factors. Correlations between the factors and the judgment by the three inner judges (i.e. course instructors) are presented in Table 3.

For "personality" as shown in Table 3, the correlation coefficient for teacher C's scores and the influential factor "full of confidence" is 0.309 ( $p = 0.017$ , less than 0.05). It is possible that the judge rated the imaginative capacity of students who expressed this with confidence than those who did not. The scores of the judge A and B did not correlate with any factors of this aspect, suggesting that these two teachers treated all the factors of personality traits equally and did not put emphasis on any specific factor. For "study atmosphere," the correlation coefficient between the judge A's scores and influential factor "interactive discussion" is 0.341 ( $p = 0.008$ , less than 0.05). This finding indicates that the judge considered that interactive discussion between instructors and students or between students themselves in the class can effectively improve imagination. The scores of the judge B and C are not significantly correlated with the influential factors of this aspect, indicating that these two teachers treated all the factors of learning atmosphere equally and did not put emphasis on any specific factor. For "imaginative thinking," the correlation coefficient for teacher A's score and influential factor "information heterogeneity" is 0.293 ( $p = 0.020$ , less than 0.05). This finding indicates that the teacher considered that the existence of variation in the collected data can stimulate pluralistic associative thinking among the students. The correlation for the judge A's scores and influential factor "information acceptability" is 0.530 ( $p = 0.000$ , less than 0.05). This finding indicates that the judge put emphasis on whether the materials collected by the students are relevant to the theme of the creative project. The correlation coefficients for the three instructors' scores and influential factor "material relevancy" are 0.586, 0.411, and 0.357, respectively ( $p = 0.000$ , 0.001, and 0.004, respectively, suggesting significant correlations). This finding indicates that these three teachers put emphasis on the elements collected by the students for the creative project and considered that these elements should be related rather than scattered or unrelated. Similarly, the correlation coefficients for the three instructors' scores and influential factor "information appropriateness" are 0.575, 0.304, and 0.532, respectively ( $p = 0.000$ , 0.015, and 0.000, respectively, suggesting significant

correlations). This finding indicates that the judge placed a similar level of emphasis on whether the materials used for the renovation site are reasonable.

For “imaginative thinking,” the correlation coefficient for the judge A’s scores and influential factor “drawing relevancy” is 0.403 ( $p = 0.001$ ). This finding indicates that the judge considered that the rough diagram prepared by the students should be related to the theme instead of being completely unrelated. The correlation coefficient for the judge B’s scores and “detailed description” is 0.324 ( $p = 0.009$ ), indicating that the instructor put emphasis on the level of detail in the students’ drawing. The three teachers all stressed the importance the components being varied, and the correlation coefficients are 0.440, 0.503, and 0.422, respectively ( $p = 0.000$ ,  $0.000$ , and  $0.001$ , respectively, suggesting statistical significance). This finding indicates that having pluralistic components in the rough diagram is an important factor that influences the teachers’ judgment of students’ imagination. The correlation coefficients for the scores of teachers A and B and ‘story context’ are 0.281 and 0.371 respectively ( $p = 0.026$  and  $0.03$  respectively, all less than  $0.005$  and thus statistically significant). This finding indicates that these two teachers preferred to see students presenting a complete story in the rough diagram, as this gave the story more life and vibrancy. “Imagination comprehensiveness” was a factor emphasized by the judge A; the correlation coefficient is 0.456 ( $p = 0.000$ , less than  $0.05$ ). This indicates that the judge thought that the students should consider all the techniques and theories that are used for each stage of the project, and they should possess a good understanding of the theories and techniques and apply them skilfully.

**Table 3.** Correlations between the factors and the three judges’ final judgements.

Judges	Correlation	Factors from Personality									
		IQ	Pleasantness	Responsibility & Enthusiasm	Emotional stability	Management	Self Control	Dominance & Control	Pursuit of Changes	Curiosity	Work Hard
A*	Correlation coefficient	0.201	0.139	-0.006	-0.004	0.077	0.062	0.175	0.183	0.073	0.201
	Signification p	0.126	0.294	0.962	0.979	0.560	0.641	0.186	0.164	0.581	0.127
B*	Correlation coefficient	-0.009	0.151	0.052	0.157	0.206	-0.004	0.166	0.056	0.046	0.202
	Signification p	0.949	0.255	0.694	0.236	0.118	0.974	0.210	0.671	0.729	0.125
C*	Correlation coefficient	0.059	0.116	-0.025	0.124	0.156	0.002	0.084	0.142	-0.089	0.309
	Signification p	0.655	0.381	0.853	0.350	0.239	0.990	0.529	0.283	0.053	0.017*
		Factors from Study Atmosphere									
		Question Encouraged	Positive Affection	Interactive Discussion	Assumption Questions	Supplementary Visual/Audio Teaching Materials	Teacher-Demonstration	Answering Students' Questions	Homework Assignment	Art Activities	Art knowledge
A*	Correlation coefficient	0.053	-0.003	0.341	-0.125	-0.095	-0.030	-0.142	0.104	0.202	0.167
	Signification p	0.692	0.984	0.008*	0.346	0.476	0.824	0.284	0.434	0.126	0.207
B*	Correlation coefficient	-0.084	-0.012	0.204	-0.188	-0.052	-0.035	-0.038	-0.051	0.120	0.043
	Signification p	0.527	0.929	0.121	0.154	0.694	0.795	0.777	0.702	0.367	0.745
C*	Correlation coefficient	-0.173	-0.063	0.122	-0.126	-0.120	-0.178	-0.154	-0.044	0.068	-0.044
	Signification p	0.190	0.634	0.355	0.342	0.365	0.176	0.244	0.742	0.607	0.740

Judges	Correlation	Factors from Imaginational Thinking														
		Information Volume	Information Interogeneity	Information Acceptability	Material Relevance	Information Appropriateness	Drawing Relevance	Detail Description	Component Function	Story Content	Imagination Comprehensiveness	Original Insight	Imagination Integration	Expansibility	Imagination Refinement	Interesting Level
A*	Correlation coefficient	0.007	0.293	0.530	0.568	0.575	0.403	0.103	0.440	0.281	0.456	0.398	0.267	0.311	0.217	0.385
	Significance p	0.954	0.009*	0.000*	0.000*	0.000*	0.001*	0.423	0.000*	0.026*	0.000*	0.001*	0.034*	0.013*	0.008*	0.002*
B*	Correlation coefficient	0.011	0.234	0.077	0.411	0.304	0.236	0.324	0.503	0.371	0.214	0.365	0.202	0.351	0.185	0.351
	Significance p	0.933	0.005	0.551	0.001*	0.035*	0.062	0.009*	0.000*	0.003*	0.093	0.003*	0.112	0.005*	0.197	0.005*
C*	Correlation coefficient	-0.086	-0.069	0.073	0.357	0.532	0.107	0.181	0.422	0.097	0.168	0.390	0.179	0.392	0.126	0.406
	Significance p	0.504	0.593	0.572	0.004*	0.000*	0.405	0.156	0.001*	0.449	0.189	0.002*	0.159	0.001*	0.324	0.001*

Note: # Judge A, B and C are also course teacher A, B and C respectively.

\* denotes significantly correlated.

For “imaginative thinking,” the three teachers all considered “original insight” to be critical, and the correlation coefficients are 0.398, 0.365, and 0.390 respectively ( $p = 0.001, 0.003, \text{ and } 0.002$ , all less than 0.05 and thus statistically significant). This finding indicates that students’ final products should be distinct in order to be innovative; moreover, they should not be derivative or cliched. For the influential factor “imagination integration,” only the judge A’s scores indicate a significant correlation (correlation coefficient = 0.267,  $p = 0.000$ , less than 0.05 and thus is statistically significant). In other words, this teacher valued students’ ability to integrate their imaginative integration capacity and all the suggestions into a comprehensive notion and then apply this integrated idea to the final product. ‘Expansibility’ is another important influential factor. The correlation coefficients for the scores of the three instructors are 0.311, 0.351, and 0.392, respectively ( $p = 0.013, 0.005, \text{ and } 0.001$ , respectively, all less than 0.05 and thus statistically significant). This finding indicates that the three teachers put emphasis on whether a project possesses market or development potentials. For “Imagination refinement,” the correlation coefficient for the judge A’s evaluation scores is 0.217 ( $p = 0.000$ , less than 0.05 and thus statistically significant). This finding indicates that this judge considered that student’s imagination should be comprehensive and sophisticated instead of superficial. For “interesting level,” the three judges shared a similar perspective. The correlation coefficients for the scores of the three instructors are 0.385, 0.351, and 0.406, respectively ( $p = 0.002, 0.005 \text{ and } 0.001$ , respectively). This finding suggests that all the judges considered that projects that are more humorous and fun are better at attracting consumer attention and interest.

According to the above analysis, there are numerous influential factors from the imaginative thinking aspect that are significantly correlated with the three judges’ judgments. These findings have revealed that students with better imaginative performance are more likely to gain approval from the three judges and thus score more highly in their final judgment.

## Conclusion

There is no doubt that the imaginational capability of students majoring in design does affect the quality of their final works. This research found that imaginational thinking processes during class exert more of an influence on the quality of the design work than either personality or study atmosphere. As a result of this, it is clear that how best to encourage students to cultivate their imagination during the imaginational

thinking process is a topic well worth investigation in the context of education research. During the experimental teaching session undertaken in this study, students from the experimental group received supplementary teaching material that was designed to assist them in material collection for their imaginational achievements. Although statistically this supplementary teaching material did not much significantly enhance students' imaginative capabilities, the experimental group using the supplementary material still performed better than the control group did. In other words, factors that are highly correlated with the grade of the project, *e.g.* information appropriateness, original insight, and interesting level, should be stressed much more than they are currently in the new edition of the supplementary teaching material.

As for the plans for future research related to design imagination, due to various restrictions, only junior students major in creative design at National Yunlin University of Science & Technology participated in this experiment. It will be a good idea to expand the scope this study to other fields or groups to gain more fully understanding on the actions and effects of imagination. For example, the experimental teaching can be given to design-major students at regular universities and technology colleges respectively to investigate their imagination performance. This is a way for assessing differences between various teaching environments in Taiwan.

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