

Scratch Teaching Mode of a Course for College Students

<https://doi.org/10.3991/ijet.v16i05.21269>

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Abstract—Maker education is of great significance for the fostering of innovative talents. At present, however, most of the maker courses in colleges and universities are with such problems as single teaching functions, non-uniform course management system and unsmooth course teaching. Therefore, how to innovate in concept, system and mode to adapt them to the new demand of the development of higher education is a realistic problem to be addressed by maker course. Guided by the teaching concept of STEAM, our study establishes maker education oriented on learners and implements the hands-on operating experience of “creating, delighting, cooperating and sharing”. Meanwhile, the teaching design of Scratch programming education dominated by game-based learning is taken as an auxiliary teaching measure. Moreover, four teaching modules, i.e., design development teaching, artistic design teaching, manual production teaching and 3D printing teaching, are also created. On this basis, a model for the development elements of the thinking of maker education is proposed to evaluate the training effect of innovation ability by this teaching practice. The results show that the proposed teaching mode can effectively improve students’ learning ability and innovative thinking. Hopefully, the present study can offer a reference for researchers and practitioners of maker education.

Keywords—Scratch teaching mode; maker course; STEAM; Chinese teaching

1 Introduction

In an effort to cope with global competitions for innovation ability, schools in various countries have raised a series of innovative strategies successively. The essence of this series of innovative strategies is to promote the national innovation ability. Maker education is precisely a new innovative education mode, which reflects the development trend the future education and exerts a major impact on individual development, curriculum reform, reform of education system and fostering of national talents [1]. However, maker education is still in its infancy in education, and there are still key problems to be solved in the construction of the course, such as a lack of professional design in the teaching system and operation mode of maker course, the imperfect system and the poor operation mode, etc, all of which are common problems in the construction of makerspace in colleges and universities [2]. How to innovate in concept, system and mode to adapt them to the new demand of the

cultivation of innovative talents in colleges and universities is a realistic problem to be addressed by maker course. Simultaneously, in the previous teaching mode, Chinese teaching generally adopts outdated teaching methods, and passes on knowledge points to students using blackboard writing and notes [3]. Such kind of teaching method is not conducive to the improvement of students' learning interest and the cultivation of college students' innovation ability.

In view of this, by integrating maker course with Chinese teaching and applying Scratch teaching mode, this study fuses more game-based classes into Chinese teaching. Secondly, it fully merges the teaching concept of STEAM and boosts integrated education across multiple disciplines. Finally, based on our study, a model for the development elements of innovative thinking is established, with a view to evaluate the training effect of innovation ability by this teaching practice. Hopefully, a new perspective can be provided for the combination between maker education with other professional classes.

2 State of the Art

In today's information era, new technologies such as Internet plus, cloud computing and artificial intelligence have emerged as the times require. All walks of life have undergone rapid changes, and information technology has exerted a revolutionary impact on education. Under the background of new technologies, "maker education" has far and away become a focus of attention to the educational circles and even various fields of the society. "Makers" [4] refer to those who are bold in making innovations, strive to turn their ideas into reality, stress learning by doing and value design and sharing. Makers education is a novel form of innovative education. In the United States [5], the government and society have attached great importance to maker movement and their education. Maker education has become an important channel for this country to propel educational reform and cultivate innovative talents of science and technology. The government have also launched a "maker education program", to make every child a maker, develop a variety of maker projects by setting social makerspace, and inspire children's imagination and creativity. The maker education in U.S. colleges and universities links on-campus education and off-campus education in an organic way, in order to build social public creative space and offer a development platform for students to unleash their creativity. Hundreds of colleges and universities, including prestigious ones like the Massachusetts Institute of Technology, Harvard University, and Stanford University, have built makerspace, maker archives, maker libraries and maker laboratories, etc. To date, there are more than 150 universities and 130 libraries in the United States offering venues funds and faculty for maker education [6]. Under the leadership of maker education in the United States, developed countries like the European Union, Canada and Japan have also joined the rank of the maker education movement. Many developing countries also gradually become aware of the potential strategic prospect of this movement and take active countermeasures. Forest et al. [7] considered that creativity, invention and innovation were core pillars of engineering education. Their

team applied manufacturing and prototyping space in Georgia Institute of Technology as a “machine workshop” for maker education and built an invention studio. Practical results showed that such kind of training mode can help develop students’ creativity. Brady et al. [8] explored articles describing the planning and execution of an accessible library makerspace event for people with disabilities. Their team tried to design maker education activities in local public libraries. Their practice was not only endorsed by library readers, but also beneficial to the improvement of e readers’ creative thinking. Saorín et al. [9] launched a maker education campaign in La Laguna University to stimulate students’ innovation ability. The team created a teaching environment using digital editing tools and 3D printing technology. During learning, digital manufacturing technology was used to turn ideas into digital designs and convert these ideas into tangible products through 3D printing, which offers opportunities for the development of creativity. The results show that such kind of maker education activity can improve students’ creative ability.

So far, with respect to the cultivation of training innovative talents, the curriculum system of Chinese college lags behind that of western developed countries. As a result, a large number of college graduates face difficult employment after graduation [10]. Under the circumstance, it is quite necessary to improve students’ innovation awareness and cultivate their innovative spirit and hands-on ability. Maker education is an urgent need of the teaching reform in China. On the other hand maker course also keeps reforming and making process. Wan et al. [11] presented a development model for maker course, which can be divided into three layers: core layer, element layer and development layer. With Lego WeDo 2.0 Resource Pack as the teaching content, they developed a 16-hour maker course for the fifth grade of primary school and achieved a good teaching effect. Si et al. [12] fused PBL (project-based learning) and DBL (design-based learning) to create students’ wework space and other shared resources and applied them to maker course. The results showed that the proposed mode was in line with students’ learning habits and can improve their practical operation ability. Maker teams from some colleges and universities in China also built online communities on the Internet to publish information, share resources, exchange and learn and teamed up with individual makers to develop maker projects. Students can exchange information outside class through forums, websites, WeChat, microblog and other online communities. They share online design and online cooperation, while displaying the creation process and creation products of physical space, Luo et al. argued that in maker teaching, virtual space can display learning resources, support tests and simulated training and manage maker projects, and so on. Zeng et al. [13] contended that cyberspace oriented to student makers was a virtual online learning environment backed by services in “seven dimensions”, that is, online maker courses, virtual practice, maker resources, maker sociality, online services, display & sharing and learning management. However, despite the process of maker course in Chinese colleges and universities, the development of maker course in colleges and universities is still in its infancy and there is no complete and systematic maker course system. In most colleges and universities, the maker courses are inclined to science, engineering, business and art. Additionally, the conditions for maker education, such as maker supervisor resources, software and hardware development resources and

community platform for sharing are not ripe in some colleges and universities, and there is still a certain gap from the realization of genuine maker education. On the other hand, there is a lack of an objective system to evaluate the training of innovation ability by maker course, which is not favourable for the reform and development of maker course.

In view of the above problems, in an innovative way, this study takes the teaching concept of STEAM featured by interdisciplinarity as the basis, establishes a student-oriented maker course, and emphasizes that the learning practice should be performed by completing projects. At the same time, for the first time, the teaching design of Scratch programming education dominated by game-based learning was taken as an auxiliary teaching measure and applied to Chinese course to set up four teaching modules: design development teaching, artistic design teaching, manual production teaching and 3D printing teaching. On this basis, qualitative analysis and exploratory factor analysis were conducted on the development elements of students' innovative thinking, and a model for the development elements of the thinking of maker education was built, to evaluate the training effect of innovation ability by this teaching practice. Hopefully, the present teaching practice can fill the gap of existing research, drive the development of maker and provide a valuable reference for the maker course and innovative education of developing countries.

3 Scratch Teaching Mode of Maker Course for College Students Based on STEAM Theory

3.1 To blend STEAM theory into the maker course

STEAM theory is an interdisciplinary course, which is composed of such disciplines as science, technology, engineering, art and mathematics. This teaching theory is characterized by knowledge interdisciplinarity, problem generation and innovation drive, etc. It not only embodies the integration, practice and activity tendencies of course, but also reflects the essence that course will return to life, return to society and return to nature. The interdisciplinary strength of STEAM theory and project-based or problem-based teaching methods allow maker activities to better cater to the demands of school education and talent training and make the goals, direction and implementation process of maker education clearer. While helping students lay a solid knowledge in science, technology, engineering and mathematics, it also fosters their innovative spirit and hands-on ability. Guided by STEAM theory, our study sets up an Innovation Centre of Science, Technology and Art for College Students, an all-round, open and interactive platform for school-level innovation practice that integrates innovation training, technical training, academic exchange, design development and artistic creation into one. The teaching mode is shown in Fig. 1. As shown in Fig. 1, the concept of STEAM is an educational concept with creativity and scientific integration, and creativity itself is the core of maker course. According to the concept of STEAM, maker course and maker space teaching mode should build design development module, artistic design module, manual production

module and 3D printing module and establish an execution standard, the division of labor and targets, by fully focusing on the concept of innovation drive. On this basis, maker course and relevant trainings are given and a teaching mode with diversified innovation is constituted, thereby achieving an overall improvement of college students' professional skills, innovation ability and learning literacy, etc.

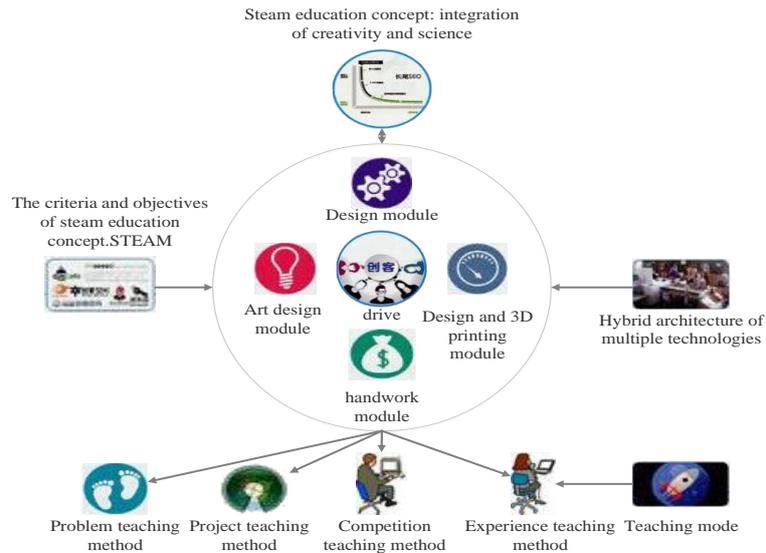


Fig. 1. The Framework of the Makerspace Teaching Mode under the concept of STEAM

3.2 The design of a maker course based on scratch teaching mode

Scratch is a graphical programming tool developed by the Massachusetts Institute of Technology, which is mainly open to teenagers. As of 2020, there had been versions 1.4, 2.0, 3.0 and 3.12.0. Anyone can create his/her own program in any version. Any teaching mode using the auxiliary teaching tool of Scratch is called a Scratch teaching mode. In Taiwan, for example, basically all information technology courses for primary and middle school students are based on this software. There are many such websites. The teaching effect of Chinese, mathematics and foreign languages can be improved through this software. It can be seen from Fig. 2 that Scratch teaching mode is also an important teaching mode and concept that can be used for reference in the design of maker course for college students. By taking STEAM as the basic concept, our study makes a wise use of the Scratch editing software, synthesizes teaching resources inside and outside the school and pushes forward project-based learning, game-based learning, incentive teaching and diversified evaluation. It not only nurtures students' computational thinking and comprehensive abilities, but also raises their learning interest. For example, on the setting of course objectives, teachers first understand the specific situation of students

and evaluate their computational thinking and comprehensive abilities. On the basis of n students' cognition, Scratch programming software is applied to help students learn to combine programming with the knowledge of Chinese course and edify their literary literacy and creativity. It leads students to solve practical problems in Chinese learning using Scratch mode, improves their problem-solving ability, reinforces their learning of language and literature, brings Scratch teaching into full play and carries out maker education in an “interdisciplinary” way. As for the subject knowledge goal of this course, it belongs to interdisciplinary learning and advocates the learning mode of “Scratch + multidisciplinary”. The conventional learning mode is changed through course design, interdisciplinary integrated teaching is offered, to enable students to take their initiative to learn knowledge as needed, solve problems with the knowledge and skills they have learned, and perfect the building of their self-knowledge system.

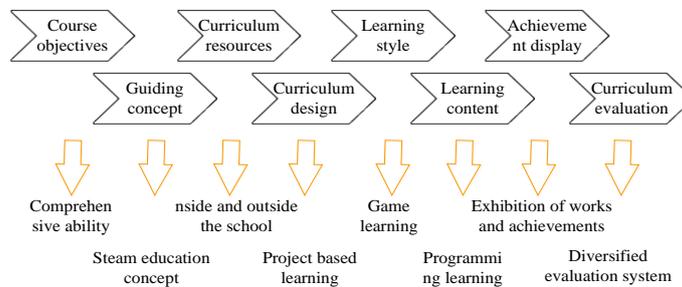


Fig. 2. The Design Model of a Scratch Teaching Mode Course

3.3 The combination with new teaching materials in the teaching of mixed psychology

Maker education, in essence, is an effective way to create, generate and develop college students' innovative thinking. According to Wallas' “four-stage model” of key psychological process, the method of nature research was taken to probe into this problem, and factors in the research model were analysed and screened. With development elements of innovative thinking in college maker teaching as the topic, college teachers, psychological experts, education technology experts, college students and school teachers were interviewed, and the interview results were screened by NVivoll to obtain the above factors.

Through an overall consideration of a variety of models, 4 common factors and various correlation fitting indicators were obtained, and 4 factors were selected for exploratory analysis. The specific factors and indicator analysis results are shown in Tab. 2.

Table 1. Node Information in the Interview about Development Elements of Innovative Thinking

Parent Node	Child Nodes	Reference Points	Parent Node	Child Nodes	Reference Points
Divergent thinking	Fluency	6	Figurative thinking	Reproductive imagination	2
	Flexibility	3		Creative imagination	4
	Uniqueness	6		Combinational imagination	3
	Delicacy	3		Analogical association	2
	Sensitivity	4		Simulative association	2
Critical thinking	Truth-seeking	2	Direct thinking	Simplicity	3
	Open-mindedness	4		Power of observation	5
	Analytical ability	2		Self-confidence	4
	Systematic ability	3	Comprehensiveness of thinking	Breadth of thinking	3
	Self-confidence	5		Depth of thinking	4
	Thirst for knowledge	3		Subject integration ability	2
	Cognitive maturity	1			
Creativity tendency	Adventurousness	3			
	Curiosity	5			
	Challenge-seeking	3			
	Imagination	5			

Table 2. Observed Variables and Factor Loading of ESEM Exploratory Structural Model

Factor 1		Factor 2		Factor 3		Factor 4	
Item	ESEM	Item	ESEM	Item	ESEM	Item	ESEM
Q453	0.774	Q49	0.809	Q470	0.833	Q454	0.436
Q461	0.759	Q44	0.625	Q464	0.827	Q434	0.407
Q476	0.762	Q428	0.569	Q467	0.796	Q437	0.405
Q479	0.649	Q433	0.562	Q462	0.761	Q438	0.381
Q45	0.648	Q419	0.513	Q459	0.727	Q427	0.372
Q446	0.636	Q477	0.509	Q478	0.671	Q428	0.368
Q444	0.608	Q47	0.489	Q468	0.654	Q445	0.321
Q460	0.591	Q416	0.483	Q477	0.637	Q422	0.31
Q474	0.579	Q427	0.486	Q471	0.634		
Q442	0.509	Q46	0.45	Q448	0.568		
Q48	0.491	Q418	0.431	Q475	0.51		
Q42	0.474	Q421	0.409	Q469	0.406		
Q43	0.471	Q420	0.383	Q421	0.356		
Q438	0.468	Q436	0.356	Q458	0.351		
Q435	0.461	Q437	0.33	Q474	0.349		
Q432	0.43	Q439	0.329	Q417	0.346		
Q441	0.431	Q469	0.315	Q460	0.339		
Q47	0.427			Q457	0.341		
Q434	0.408			Q433	0.335		

Q456	0.39			Q456	0.331		
Q473	0.346			Q472	0.331		
Q445	0.337			Q436	0.329		
				Q441	0.32		
				Q418	0.318		
				Q440	0.304		

There were mainly four factor indicators, that is, divergent thinking, figurative thinking, propositional thinking and intuitive thinking, which were represented by f1, f2, f3 and f4 respectively. Different factors contained different connotations, had different functions and exerted different effects. The details are shown in Tab. 3.

Table 3. Description about the Development Elements of Innovative Thinking

Symbol of Factor	Name of Factor	Description of Factor
f1	Divergent thinking	Think in different directions, rearrange the existing information and information in the memory system, to generate novel ideas and viewpoints.
2	Figurative thinking	Take visual images or representations as carriers, and meditate with intuitive images and representations.
f3	Propositional thinking	Evaluate the existing implementation correctly with truth-seeking, rigorous and self-reflective thinking, put forward a hypothesis on this basis, and verify the hypothesis.
f4	Intuitive thinking	Make judgments based on direct contact with things, phenomena and changes.

The goal of EFA was to explain the correlation of a set of observable variables by mining a set of fewer and more fundamental unobservable variables hidden under the data. These virtual and unobservable variables were called factors. (Each factor was regarded to explain the common variance of multiple observed variables, which was also called common factor)

The form of the model was:

$$x_i = a_1F_1 + a_2F_2 \dots a_pF_p + U_i$$

X_i was the i^{th} observable variable ($i = 1, 2, \dots k$)

F_j was a common factor ($j = 1, 2, \dots p$)

And $p < k$

Exploratory factor analysis also had some limitations. First of all, it assumed that all factors (after rotation) can influence the measure. In actual research, we often supposed that there is no causality in one factor, so it may not influence the measure term of another factor. Secondly, exploratory factor analysis assumed that the residuals of measure terms were independent of each other. As a matter of fact, the residuals of measure terms can be correlated due to common method bias, sub-factors, etc. Thirdly, exploratory factor analysis required that all factors should be independent. Although this was an unavoidable makeshift when solving the number of factors, it was inconsistent with most of the research models. Most obviously, the independent variable and the dependent variable should be correlated, rather than independent of each other.

The strength of confirmatory factor analysis was that it enabled researchers to clearly describe the details in a theoretical model. Due to the existence of measurement errors, researchers needed to adopt multiple measure terms. After the adoption of multiple measure terms, we were faced with the problem of the “quality” of measure term, that is, validity test. The validity test was meant to see whether a measure term had a significant load on the factors that it designed, and no significant load on factors that had nothing to do with it. Of course, we can carry out further tests on whether there existed a common method bias in a measure term tool and whether there were “sub-factors” among some measure terms. These tests required researchers to clearly describe the relationship among measure term, factor and residual. The description of this relationship was also known as measurement model. The test of a measurement model was a confirmatory measurement model, and the quality test of measurement model was an indispensable step before hypothesis testing.

Both of these two kinds of factor analysis took common factor analysis model as the theoretical basis, and their main purpose was to condense data. Through a correlation study on a large number of variables, the main information of original variables (observed variables) can be expressed by a few imaginary variables (factors and latent variables). The following formulatic model was exactly the simplest and also the most common factor model. Each observed variable (indicator) had only one factor (latent variable) on which the load was not zero. x_1, x_2 and x_3 were indicators of the latent variable ξ_1 , x_4 and x_5 were indicators of the latent variable ξ_2 .

$$\begin{aligned}\sigma_1 &\rightarrow x_1 \leftarrow \lambda_{11} \\ \sigma_2 &\rightarrow x_2 \leftarrow \lambda_{21} \leftarrow \xi_1 \\ \sigma_3 &\rightarrow x_3 \leftarrow \lambda_{31} \\ \sigma_4 &\rightarrow x_4 \leftarrow \lambda_{42} \\ \sigma_5 &\rightarrow x_5 \leftarrow \lambda_{52} \leftarrow \xi_2\end{aligned}$$

After the factor model shown above was generalized to factor model in the general sense, the relationship between various observed variable x_i and m common factors $\xi_1, \xi_2, \dots, \xi_m$ can be expressed by the following mathematical model:

$$\begin{aligned}x_1 &= \lambda_{11}\xi_1 + \lambda_{12}\xi_2 + \dots + \lambda_{1m}\xi_m + \sigma_1 \\ x_k &= \lambda_{k1}\xi_1 + \lambda_{k2}\xi_2 + \dots + \lambda_{km}\xi_m + \sigma_k\end{aligned}$$

Where x_i was various observed variables; ξ_i was the common factor; σ_i was the special factor of x_i , sometime known as error term. It included two parts: uniqueness factor and error factor. λ_{ij} was the load of the common factor; m was the number of the common factors $\xi_1, \xi_2, \dots, \xi_m$ and k was the number of all observed variables x_1, \dots, x_k . $mx = \Lambda_x \xi + \sigma$.

Where:

$$x = (x_1, x_2, \dots, x_k)^T, \xi = (\xi_1, \xi_2, \dots, \xi_m), \sigma = (\sigma_1, \sigma_2, \dots, \sigma_k)^T$$

$$A = \begin{bmatrix} \dots \\ \lambda_{11} \wedge \lambda_{1m} \\ \wedge \wedge \wedge \\ \lambda_{k1} \wedge \lambda_{km} \end{bmatrix}$$

was the load matrix.

Based on exploratory factor analysis results of the development elements of innovative thinking, it was concluded that: the development elements of innovative thinking consisted of four parts: divergent thinking, figurative thinking, direct thinking and critical thinking. While facilitating the development of innovative thinking, the development elements of innovative thinking had a dialectically unified relationship with their corresponding thinking forms. According to the classification theory of innovative thinking: divergent thinking corresponds to vertical thinking.

Based on the analysis results of the expert interviews on the development elements of innovative thinking and theories related to maker education, four dimensions based on the above calculation process and theories were defined as the model system of the development elements of innovative thinking. The specific operation process and strategies are shown in Fig. 3:

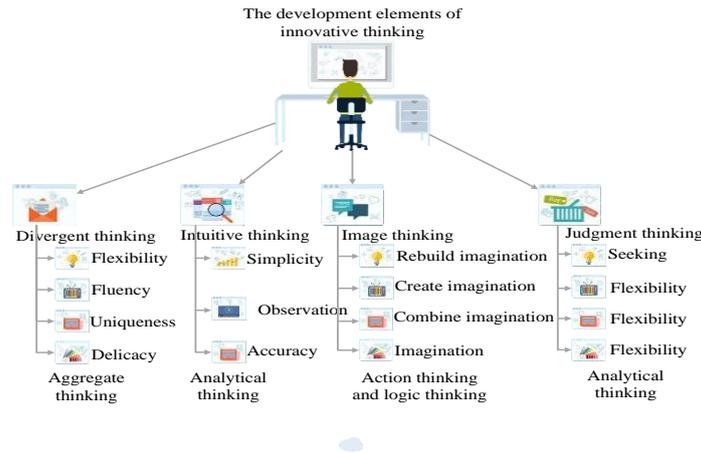


Fig. 3. The Model System for the Development Elements of Innovative Thinking

4 Teaching Example and Effect

4.1 Teaching example

The college students' maker course mode dominated by Scratch teaching was similar to the structure of traditional classroom. The maker course project was propelled and implemented, with teachers as the leader of classroom and students as the subject. The teachers collected plenty of teaching materials inside and outside college. These materials needed to fully focus on the teaching concept of maker. In

this way, the Scratch teaching mode was fused, students are inspired to carry out deep research spontaneously and discover problems on their own. The teachers served as the leader and eventually studied, reflected, evaluated and shared the course results. The specific process is shown in Fig. 4.

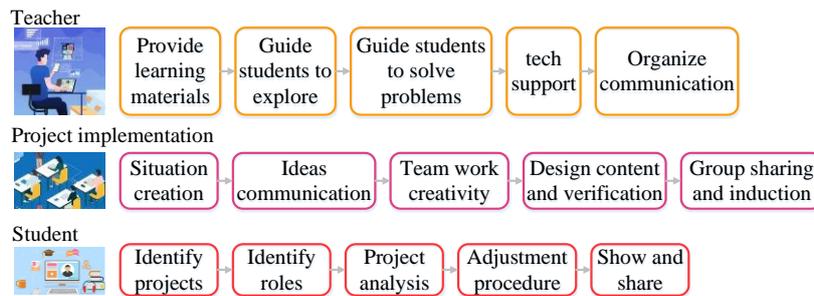


Fig. 4. The Teaching Process of Maker Education for College Students in Chinese Course

As can be seen from Fig. 4, in the college students’ maker course based on Scratch, the first thing to do was to set up a teaching scenario and identify the content of project: teachers set up teaching objects to be attained according to the actual situation of students, created learning contexts and provided teaching materials. The teaching provided supplied in this study mainly centred on Chinese literacy, such as tea culture and classical music in China. The display of teaching materials is shown in Fig. 5.



Fig. 5. Display of Teaching Materials in Maker Education for College Students in Chinese Course

At this stage, students identified a project topic, based on the literary project materials supplied by their teachers. They conceived ideas and communicated in groups. Teachers instructed them to create based on project data and students’ actual experience. Students pondered about the project, conceived ideas, communicated with each other, and finally identified their project roles. The teams cooperated and materialized their ideas. The teachers directed students to think about each part of the project, further inspired their imagination and creativity, led them to discover

problems and come up with solutions. In this process, teachers needed to pay attention to students' logic and implementability (as shown in Fig. 6).



Fig. 6. Display of Teachers' Guidance in College Students' Maker Course

At this stage, students worked in tandem, to analyse the project and draw a flow chart. The course content was established: students made repeated attempts on the basis of communication. In this process, the teachers mainly offered technical supports beyond the cognition scope of students. At the same time, the students shared in groups, summarized and displayed. They demonstrated their final projects and evaluated among different groups. Students and teachers discussed problems and solutions in the learning process together. The teachers guided students to grasp knowledge, improved their problem-analysing and problem-solving abilities and thereby cultivating their creative thinking. Fig. 7 shows the teacher-student interaction in college students' maker course.



Fig. 7. Display of Teacher-student Interaction in College Students' Maker Course

4.2 Teaching effect

In order to verify the teaching effect of the whole teaching mode, this paper put it into practice in a Chinese course. The control group was taught with the conventional

teaching method of theoretical lessons, that is, the teachers instructed in the form of multimedia in class and assigned homework after class. While the experimental group was mainly taught with Scratch teaching mode, to form a college students' maker course and apply it to Chinese teaching. At the end of the semester, the learning effect of two groups was compared (see Tab. 4).

Table 4. Comparison of test scores of the study group and the control group ($\bar{x} \pm s$, score)

Item	Control Group (n=45)	Experimental Group (n=45)	t	P
Creative Ability	3.39±0.41	3.12±0.44	7.803	<0.001
Information capacity	3.58±0.39	3.04±0.42	13.92	<0.001
Cooperation ability in learning	3.52±0.39	3.15±0.45	10.63	<0.001
Time management capability	3.45±0.49	3.10±0.59	8.01	<0.001
Monitoring ability of learning	3.54±0.45	3.19±0.61	8.68	<0.001
The ability to broaden information channels	3.72±0.52	3.25±0.69	5.82	<0.001
The ability to enlist help	3.52±0.42	2.84±0.72	17.75	<0.001
Communication ability	3.82±0.46	3.39±0.59	11.17	<0.001

In this study, a comparative analysis was made between the experimental group and the control group in creative ability, information capacity, cooperation ability in learning, time management ability, monitoring ability of learning, the ability to broaden information channels, the ability to enlist help and communication ability. The ability indicators of students before the teaching of college students' maker course were shown in the norm data. After a semester of training, the learning indicators of college students had been greatly improved. Creative ability was the focus of this course. The advantage of Chinese teaching based on the concept of STEAM was that it can promote the fusion of interdisciplinary knowledge. At the same time, it implied mathematical literacy, improved students' data thinking, strengthened students' scientific literacy, not only nurtured their problem-solving ability, but also enhanced their literary literacy. The creation in the literary project improved students' creative ability and information capacity. In this course, learning materials were published one week before the class. Students had a goal for preview, and through the preview and self-assessment before class, they managed to find out correct answers actively before class, their ability to enlist help is greatly improved. In the completion of project, the forms of group learning and group report were adopted, and students' communication ability is also tempered. In finding out correct answers and making reports, they acquired retrieval methods and the abilities to obtain information and knowledge points that were required and broaden data. Learners can find out and master valuable new information by themselves, thus improving their ability to acquire information.

5 Conclusion

Guided by the teaching concept of STEAM, our study creates maker education oriented on learners and applies it to Chinese course. Meanwhile, it makes an artful use of the advantages of Scratch game-based teaching, synthesizes teaching resources inside and outside the school to form project-based learning, game-based learning, incentive teaching and model evaluation of innovation literacy, in order to realize maker education for college students in the learning of Chinese course. In the teaching practice, the learning effect of the experimental group and the control group is compared, and the following conclusion is drawn:

1. The maker course based on Scratch teaching mode can effectively improve students' creative ability. The application of Scratch game programming software in maker course for college students, and the game-based teaching dominated by literary literacy can better stimulate students' interest, teach them to solve practical problems in Chinese learning using Scratch mode, and further improve their creativity.
2. The educational concept of STEAM can effectively improve students' learning ability. The advantages of the educational concept of STEAM is brought into play, the learning mode of "Scratch + multidisciplinary" is upheld. The conventional learning mode is changed through course design, interdisciplinary integrated teaching is given, to enable students to take their initiative to learn knowledge as needed, and their learning ability is also improved in an all-round way.
3. The model for the development elements of innovative thinking can better drive the development of learners' innovative thinking. Based on theories related to the psychological process of innovative thinking, by using qualitative research methods, taking the development elements of innovative thinking in college maker education as the theme and combining with exploratory factor analysis, our study builds a model for the development elements of innovative thinking, which can help educators discovers problems in students' study of maker course and improve the training of innovation ability in maker course.
4. Any theory, model and method need to go through a process from its initial proposal to its maturity. Although the conclusion presented in this study has been verified, the conclusion still needs to be improved in teaching practice. In the future, our research will be expanded in different universities and disciplines.

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Article submitted 2021-01-17. Resubmitted 2021-02-16. Final acceptance 2021-02-18. Final version published as submitted by the authors.