

Mechanism and System of Joint Postgraduate Training Based on Process Control Theory

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Keywords: Process control theory; Art design major; Joint postgraduate training; Demonstration base; Management system

Abstract: In this paper, with the process control theory as theoretical support, based on comprehensive discussions on the setting of postgraduate training objectives, the construction of curriculum system, the implementation of postgraduate joint program, the system construction of postgraduate training mechanism and the specific implementation of the whole process control on postgraduate training, the practical cases are explored and studied to show how to guide the management system and guarantee system of joint training for postgraduates in art design major by building a postgraduate demonstration base based on process control, so as to provide new enlightenment and reference value for realizing the monitoring and optimization of postgraduate training process and the comprehensive improvement of postgraduate training quality.

1. Introduction

As a new breakthrough and development opportunity for postgraduate education and talent training mode of local colleges and universities, the construction of joint postgraduate training demonstration base has promoted the issuance of the *13th Five-year Plan on Development of Academic Degree and Graduate Education* by the Academic Degrees Committee of the State Council of the Ministry of Education in 2017, which has clearly pointed out that by 2020, the development of postgraduate education should highlight the establishment of self-regulation mechanism, quality-oriented evaluation mechanism and performance-oriented resource allocation mechanism for postgraduate education to actively adapt to social needs, so as to make the construction of joint postgraduate training demonstration base greatly supported and deeply explored by universities and colleges.

In recent years, joint postgraduate training demonstration base as a major subject in the development of postgraduate education in local colleges and universities has brought about more innovation opportunities to the development and reform of local higher education, thus resulting in the generation of industry-university-research-oriented innovative mode for postgraduate training, and the active striving for and construction of joint postgraduate training demonstration base, which can further promote the professional skills, innovative application and practical ability of graduate education in Colleges and universities [1-3]. As an education mode combining theoretical learning with practical activity to improve comprehensive quality and innovation ability of postgraduates, the base construction can cultivate the postgraduate innovative talents by making full use of the two different educational environments and resources of universities and society, as well as their respective advantages in personnel training. At the same time, among the great differences between different majors, different research directions and different disciplines in the process of actively exploring the construction of joint postgraduate training demonstration base, the differences in the base construction of Humanities and Social Sciences and Natural Sciences are especially obvious. The uncertainty and adjustability in the process of postgraduate training and education make the training results affected by the establishment of training objectives and programs, the design of curriculum structure system, teachers' teaching experience, teaching facilities and teaching environment provided by the school and other factors [4].

Therefore, by referring to the way and successful experience of undergraduate training and school-enterprise (institute) joint training, this paper takes the construction of joint postgraduate training demonstration base in the College of Art and Design of Guangdong University of Finance and Economics as an example to establish the management mechanism and system for the joint postgraduate training demonstration base based on process control in the College of Art and Design, and based on which, the demand orientation, training mode and related measures based on the education and training of art and design professionals are conducted with practical analysis.

2. Theoretical elaboration: origin and development of "process control"

As a necessary theoretical mode for the development of industrial automation in the computer age, process control theory is strongly required to be closely combined with production, while the introduction of intelligent process control and the role of expert system in the development of process control theory are also the trends in the future research [5]. In short, process control theory is used to achieve the expected goal by regulating the factors that will affect the results [4]. The "process control theory" in industrial production refers to the automatic control that takes the parameters characterizing production process as the controlled variable to make it close to the given value or maintained within the given range. The general process control system usually adopts the form of feedback control, with its control system shown in Figure 1.

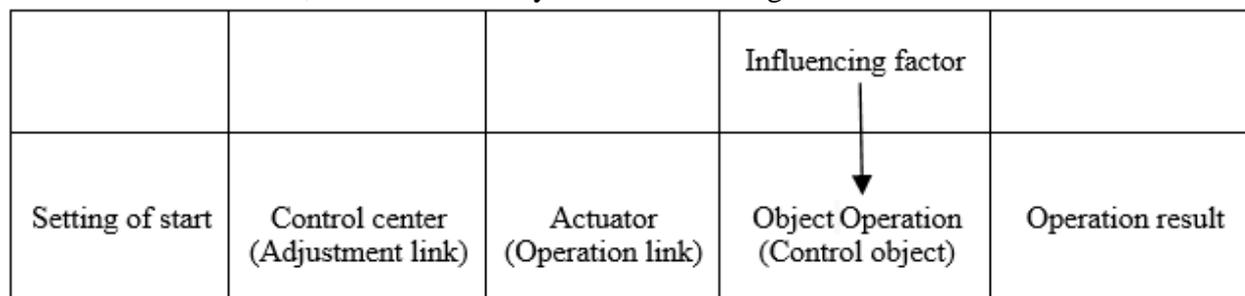


Figure 1 Model for automatic process control system

In the process control system, with a given starting point of the work, the actual operation results can be reflected by the dynamic interactions among the three main operation bodies including the regulation and control center for initial operation, the actuator as intermediate operation and the operated objects, while among which, it is more important that in the process of object operation, that is, the initial stage of control object in the readiness of given work, the relevant interference factors and uncontrollable factors affecting objects as well as other factors of counter-regulation process should be fully considered. Moreover, the comparison and analysis of the obtained relevant results through the links of information feedback and implementation degree can observe the difference between the real results and the expected results more practically, so as to lay a foundation for further overall planning and detailed arrangement.

According to observation and comparison, the model analysis and feedback regulation mechanism of process control system have high consistency with the adjustment mechanism of postgraduate training process in colleges and universities. As a comprehensive, dynamic, objective and uncertain development process, the postgraduate training in colleges and universities that is conducted with the setting of training objectives, the construction of training programs, the setting of subject system, the development of faculty team, and the facilities and environment involved in various training processes in the early stage of a given training mode will be affected and counteracted by the various uncontrollable factors of object (this should refer to the object of receiving training mode).

Therefore, the comparison between the development mode of process control theory and the construction mechanism of joint postgraduate training demonstration base can obtain the mapping model of correlation, as shown in Table 1.

Table 1 Mapping model between process control theory and joint training research mode

Process control theory	Joint training research mode
Results of the output	The object of accepting the joint postgraduate training program
Production process	The whole cycle of joint postgraduate training
Given starting value	The set training objectives and development expectations
Participation factors	Various contents of joint postgraduate training program

3. Construction analysis: necessity for construction of postgraduate demonstration base based on process control

By analyzing the drawbacks of development mode of postgraduate training demonstration base construction with the combination of its existing limitations, the role of process control theory in promoting the whole process of constructing and developing the joint postgraduate training can be further strengthened, so as to improve the execution and expectation of postgraduate education and training.

3.1 Development limitation: Single training mode of postgraduates in colleges and universities

At present, the single training mode as the limitation of postgraduate training in local universities and colleges of China includes single training scheme, assessment mechanism, training input cost and other aspects. First, the one-way indoor teaching and theoretical learning still as the postgraduate teaching and training mode in some colleges and universities makes the training stay in book learning and fail to timely and effective feedback to social work and practical abilities, while it is very common that the joint postgraduate training is too formalized on training mode. Then, the score-based ranking in the evaluation stage of postgraduate training process makes postgraduates focus on scores in learning, which deviates from the development of innovation and practice abilities in joint postgraduate training.

3.2 Being in the ascendant: Initial stage of joint postgraduate training demonstration base construction

Single training mode. In the active exploration on the construction of joint postgraduate training demonstration base by colleges and universities of China, three main modes are summarized on the basis of literature analysis and data integration, namely, the project-based innovative and practical talent training, training of school-enterprise co construction base, and joint training of intramural and extramural tutors, which also correspond to the three stages of joint postgraduate training: The first stage as the initial stage is to develop the postgraduate training mode oriented by postgraduate participation in scientific research and practical projects; the second stage is to construct the joint training bases by schools, government scientific research units and related enterprises, where the postgraduates can use their time during study to engage in practical projects related to research direction; based on the second stage, the third stage is to develop the joint training of intramural and extramural tutors by relevant scientific research institutions, enterprises and schools, with extramural tutors acted as the second tutor to assist the training of postgraduates during their study. However, the current situation of postgraduate training shows that most local colleges and universities stay in the stage of joint training based on scientific research and practical projects. Therefore, it is necessary to further explore and develop the construction and management system of joint postgraduate training demonstration base oriented by process control.

Imperfect construction mechanism. The construction mechanism for the development of single training mode mentioned above still has some deficiencies, and most of the mechanisms for joint postgraduate training established by local colleges and universities in China centre on organizational structure, that is to say, complete the training program and curriculum system through the first and the second tutors of postgraduates under joint training, while whether its training objectives have a

clear expectation is unknown. In addition, there is often no construction process of certain analysis, recirculation and re-analysis formed in the feedback mechanism of organizational structure. At the same time, the construction of joint postgraduate training demonstration base oriented by process control that has been put into practice in some colleges and universities is still in the pilot phase, whose development and formation still need a long time to be improved.

3.3 New opportunity: Construction of Process Control-based Joint Postgraduate Training Demonstration Base

As a systematic and complex engineering, the process of postgraduate training involves course study, subject research, dissertation and scientific research practice, academic lectures and other links, and the impact of uncontrollable factors on each link will result in the imperfection of postgraduate training stage, while the ability of process control theory to control each link of joint postgraduate training in real time can realize the simultaneous control and feedback on the construction of joint postgraduate training base and postgraduate education. Therefore, the construction of process control-based joint postgraduate training demonstration base can not only develop and cultivate the professional level of postgraduates, but also strengthen the exchange and cooperation between different fields of the same major, so as to promote the sharing and co construction of educational resources, and improve the practical skills and talent quality of postgraduate education. In other words, based on the strengthening of organizational structure for category establishment, the more effective control on the whole process of postgraduate training can be obtained through the interactions of adjustment links (participation of operation subject) and participation factors (factors affecting postgraduate training), as shown in Table 2.

Table 2 Trend for system and mechanism establishment of joint postgraduate training base in China

Organizational structure for category establishment	Adjustment link	Government Enterprises Research institutes Social organizations Industrial organizations	Category of process control
	Participation Factor	Training objectives Research directions Period of schooling Curriculum offered Credit requirement Training mode and method Practice and academic activities Assessment mode Dissertation	

4. Strategies for joint postgraduates training

Taking College of Art and Design of Guangdong University of Finance and Economics as a case, this paper makes a deep study on the demonstration base for cultivating master of design and master of art degree graduates under the guidance of process control, which is a social platform jointly established by universities, governments, enterprises, industries and social organizations to improve the practical and innovative ability of postgraduates. At the same time, as the main place for professional degree graduates to carry out art practice and experience, the joint postgraduate training base is an important carrier to promote and improve the high-level art talent training mode of industry-university-research cooperation, and also an important bridge for communication between enterprises and universities.

4.1 About the school

The College of Art and Design of Guangdong University of Finance and Economics, formerly known as the Art Teaching and Research Office of Guangdong Business University, was established in September 1993 and officially renamed as the College of Art and Design in March 2017. Over the years, the college has developed a trinity of professional development and talent cultivation model of teaching, scientific research and social services based on the training of creative thinking, market planning and design execution capabilities, and the promotion of the development of Guangdong, Hong Kong, Macao and the Greater Bay area and the demand for professional talents for enterprise transformation and upgrading, highlighting the characteristics of running a design major under the background of Finance and commerce.

Taking "strengthening the level of traditional superior disciplines, creating the highlights of design disciplines, and expanding the growth of new disciplines" as the discipline development strategies, the traditional superior disciplines, cross-application disciplines, new disciplines and characteristic disciplines are rationally and uniformly distributed to form the discipline characteristics of the college. The comprehensive evaluation of the first-class disciplines of design is in the forefront of the first batch of key universities in the province and the key universities at the provincial level.

4.2 Development strategy: Construction and management mechanism of joint postgraduate training demonstration base based on process control

For the master training program of the College of Art and Design, based on the undergraduate talent training program, the global awareness and professional quality of master training and education will be actively expanded to improve the creative and entrepreneurial practice ability of art and design talents. Therefore, based on the principle and system of establishing the mechanism of the joint training base for postgraduates under process control, combined with the actual development status of the College of Art and Design, the construction of professional training methods can be divided into three levels, four large sections and twelve small sections, as shown in Table 3.

4.3 Building three levels to strengthen the management system of the training process

The construction of demonstration base for joint postgraduate training in College of Art and Design mainly includes construction management mechanism system level at the overall level, four levels of construction content in the support construction system and main content level for cultivating postgraduates. By constructing abundant content levels of joint training demonstration base for postgraduates, the control factors in the whole process of postgraduate cultivation should be strengthened to serve the education and capability improvement of professional talents cultivation.

Table 3 Construction and management mechanism of joint postgraduate training demonstration base in the College of Art and Design of Guangdong University of Finance and Economics

Construction and management mechanism of joint postgraduate training demonstration base in the College of Art and Design	Base conditions construction	Construction of research laboratories
		Construction of professional database
		Construction of office equipment
	Curriculum system construction	Demonstration base practice
		Interaction between famous teachers and famous enterprises
		Institute of Scientific Research Projects
		Creative workshop
	Mechanism construction	Employment mechanism
		Management mechanism
		Communication mechanism
	Achievements of teaching and research practice	Academic forums
		Subject competitions

4.4 Focusing on four major sections to improve the basic guarantee of system construction

Through the construction of 4 major sections, namely, the construction of base conditions, the construction of curriculum system, the construction of mechanism and the results of teaching and research practice, the subject construction scope of process control is strengthened, so as to support the construction and management system mechanism of the demonstration base for the joint postgraduate training in the college.

(1) Provide reasonable services and arrangements for various measures to guarantee the construction of demonstration base based on the construction of base conditions;

(2) Strengthen the construction process of curriculum management system to ensure that all links in the process of joint training of postgraduates can be implemented smoothly. Based on the relevant joint enterprises and combined with the teaching mode of "industry-university-research cooperation", the joint postgraduate training demonstration base is provided with practical and targeted special courses by the tutors of the college and the enterprise, so as to create a complete curriculum plan.

(3) Focus on the construction of positive and effective mechanism in employment, management and communication for the education of joint postgraduate training demonstration base to better improve management mechanism, and focus on improving all aspects of institutional structure of college mechanism construction to ensure that the scope of responsibility for team building is clear and the implementation is guaranteed effectively, as shown in Table 4.

Table 4 Organization and management system framework for joint postgraduate training demonstration base in the College of Art and Design of Guangdong University of Finance and Economics

Management system of the demonstration base		Responsibilities of the demonstration base	
Principal in charge of the construction unit of the demonstration base		The planning and design of practice teaching base, the establishment and implementation of experimental teaching system of joint training base under process control, the daily real-time control and management of practice teaching base and the connection and coordination of practice teaching base	
The second level director in charge of the construction unit of the demonstration base			
Project (scientific research base) leader	Person in charge of the supporting unit of the demonstration base	The person in charge of the project (scientific research base) and the person in charge of the project execution are responsible for the specific implementation of the project practice education, center construction, management and daily operation, and for coordinating the work inside and outside the joint training base center.	Responsible for the formulation of postgraduate training plan and teaching plan, the selection and adjustment of tutors, the construction and configuration of teaching resources, the organization and implementation of teaching activities, the monitoring and evaluation of teaching quality, and degree awarding, etc.
Project (scientific research base) executive leader	Director of Service Department of demonstration base		
Tutor group in the college	Practice project tutor of demonstration base	It is mainly responsible for completing the planned education of students' practical projects (scientific research projects), guiding students to combine theory with practice, strengthening students' practice and scientific research ability, promoting students' precise employment, and sharing the cost of postgraduate education in schools.	
Postgraduates	Visual communication design Environmental art design Industrial product		

	design	
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(4) Highlight the results of teaching and research practice in order to play the role of the whole management mechanism in the whole process of training, highlight the quality of postgraduate training under the guidance of process control, and finally reflect the progress and degree of personnel training implementation with the results of practice. Cooperate with off-school enterprises to hold academic forums and guide students to participate in competitions, so as to improve the ability of our school to connect with the society and enhance the social influence of our school, and the same time of showing the strength of our students to the joint training demonstration base, and make progress in cooperation, so as to make more contributions to the industry.

4.5 Highlighting twelve small sections and bringing into play the guiding function of personnel training

(1) Perfect the facilities and conditions for the construction of joint demonstration bases with the construction of research rooms, professional databases and office equipment. First of all, the construction of an advanced "Practice Teaching Laboratory of Joint Postgraduate Training Demonstration Base" is an important carrier for the construction of system and mechanism of our Joint Training Base. Secondly, the construction of an information database relying on the joint training demonstration base can provide academic service and relevant information reference for the teaching and scientific research of the base. In addition, the college should actively increase investment in its own office instruments and equipment to ensure that students practice scientific research with the times, which is also an important part of the base condition construction; office equipment includes document input, output and processing equipment, document transmission equipment, document arrangement equipment, etc.

(2) Construct a curriculum system in many forms, such as practice platform of demonstration base, interaction between famous teachers and famous enterprises, construction of research institutes and creative workshops, to highlight the development organization of high-level talent training system with specialization, characteristics and high level. Actively organize the "collaborative" and "dual-mentor" system of joint training system, expand the guarantee of course construction of demonstration base construction in the stage of joint training for postgraduates, and organize participation model diagram of course system of joint training demonstration base based on process control. There are two types of postgraduate training modes in the College of Art and Design. According to the orientation of postgraduate colleges, academic master's degree mainly takes the training methods of tutor responsibility system, group training of supervisors and combining theoretical learning with scientific research. Professional master training emphasizes the organic combination of theoretical and practical courses in the teaching content, case analysis and practical research, and joint training with listed companies in the form of "dual tutor system", with a one-and-a-half year practice opportunity in listed companies to strengthen the practical research ability, as shown in Figure 2.

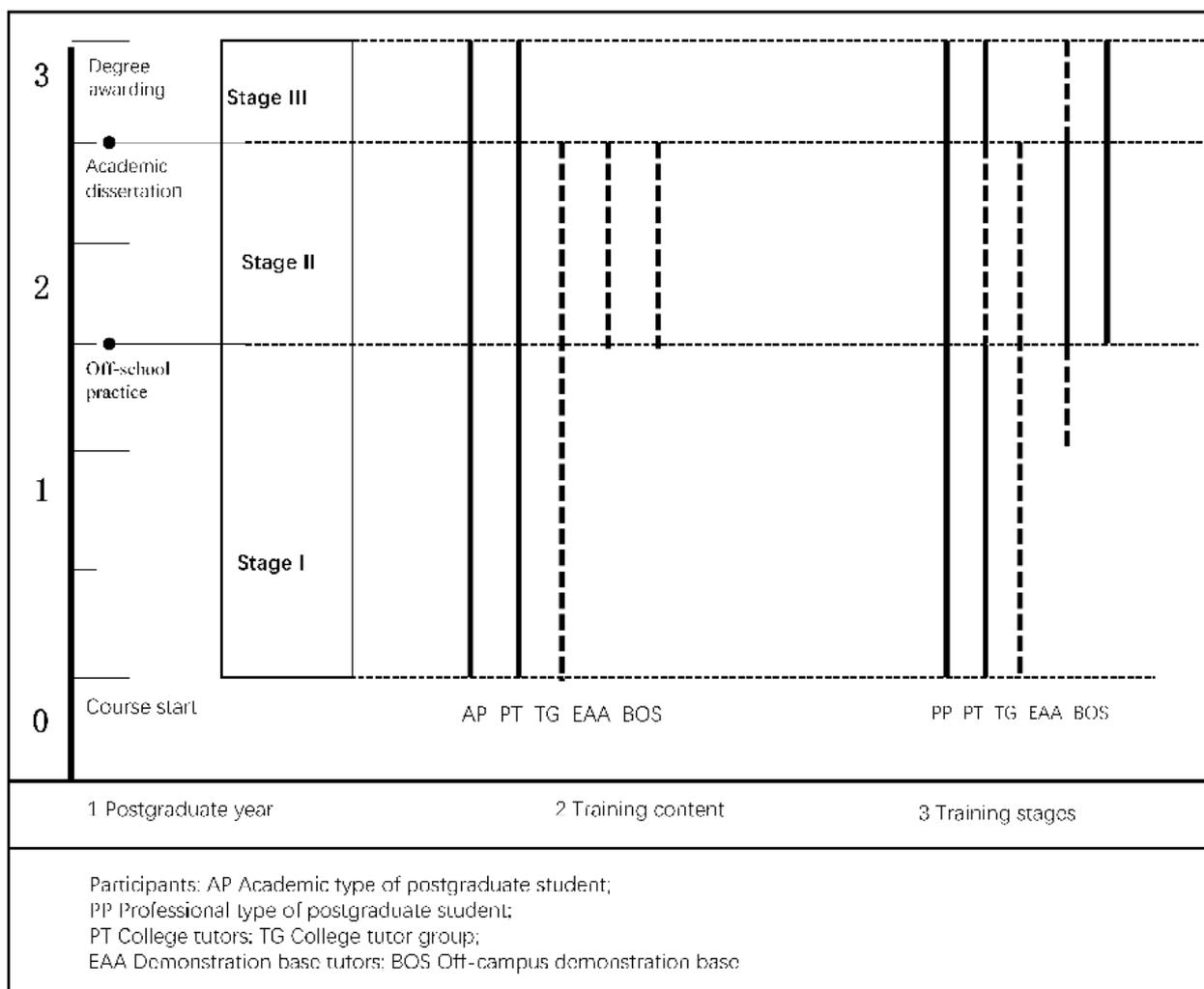


Figure 2 Participation of relevant organizations in the stage of joint postgraduate training demonstration base based on process control

(3) Implement strict employment, management and communication mechanisms, promote the control of the whole process of the construction of the joint postgraduates training demonstration base, strengthen the interaction among schools, bases and postgraduates, and effectively guarantee the objectives and methods of postgraduate training in many ways, so as to form a more powerful training system for sustainable development and normalized management.

(4) The results of teaching and research practice as the main way to reflect the quality of the joint postgraduates training and feedback the results of the base construction, will be further improved by strengthening the professional skills, academic knowledge system and practical operation ability of postgraduates in the joint training process. The College of Art and Design should take art and design as the direction of professional development, hold academic exchange activities to cultivate professional and academic ability of art and design personnel, as well as design ideas and design capabilities, to improve the overall level of postgraduate professional knowledge.

5. Conclusions

In recent years, China has made important instructions on postgraduate education, pointing out that postgraduate education plays an important role in cultivating innovative talents, improving innovation ability, serving economic and social development, and promoting the modernization of national governmental system and governance ability. The "four services" educational policy should be adhered to, aiming at the cutting-edge and key areas of science and technology, to further promote the adjustment of disciplines and specialties, improve the level of tutor team, and improve the talent training system. As an important part of talent cultivation and development, graduate education of

the College of Art and Design of Guangdong University of Finance and Economics should strengthen the construction and management mechanism of joint postgraduate training demonstration base to promote more orderly and sustainable postgraduate management and education training. At the same time, in the whole process of postgraduate cultivation, high attention should be paid to the development of quality outcomes cultivation, talent skills platform as well as demonstration base construction, so as to advance the overall degree of the postgraduate cultivation program of the college to a higher level.

Acknowledgments

The paper was supported by “A Research on the Mechanism and System of Joint Postgraduate Training Demonstration Base Based on the Process Control Theory” 2020 Postgraduate Education and Innovation Program of Guangdong Province (2020JGXM052); Guangdong University of Finance and Economics 2020 school level degree and graduate education reform research project "ideological and political practice and exploration under the guidance of morality and talent cultivation"; 2015 Guangdong Philosophy & Social Sciences Co-Construction Program “Abduction-based Design Thinking Methods and Its Applied Research” (GD15XYS02).

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