

“Joint Recruitment of Four Universities in Macao” is based on the multi-source theory

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Abstract: This study applies the multiple streams theory. It will further analyze the internal factors of the confluence of multiple sources, in order to explain why the “Joint Recruitment of Four Universities in Macao” policy has become the agenda of the Macao government. The entrance examination requirements from Macao universities are various. They increase local students’ pressure and consume their energy, thus serving as the source of the Problem Stream. The Policy Stream is represented by the Macao government’s intention to reduce students’ educational burden through establishing a unified assessment system. The Political Stream includes the Macao government’s commitment to improving the Macao education system, such as strengthening the multi-assessment system and the “The Fundamental Law of Non-tertiary Education System”. The convergence of these three sources has opened a policy window for the “Joint Recruitment of Four Universities in Macao” system, leading to a new student evaluation system. This policy not only addresses Macao’s social challenges and improves education governance while also highlighting the city’s educational diversity endeavors. Additionally, the strategies for implementing the “Four-University Joint Examination” policy include reducing the number of exams for students, implementing multi-education and multi-enrollment in higher education institutions, analyzing and improving the examination system based on educational big data, and understanding the basic elements and integration paths of big data in higher education. The Macao government can adjust major settings and enrollment quota allocation in the future, draw in more students from the Community of Portuguese-Speaking Countries and the “Belt and Road” regions, and integrate the joint admission method into the Greater Bay Area education cooperation in order to meet the needs of the growing Macao education industry.

Keywords: multi-source theory; “Joint Admission Examination for Macao Four Higher Education Institution” policy; unified assessment system; educational policy; Macao higher education

1. Introduction

1.1. Macao higher education entrance examination background

The “Joint Admission Examination” for Macao Four Higher Education Institutions is one of the admission methods used by the Macao government to evaluate students entering higher education institutions. It has important educational, social, and cultural functions.

On 20 December 1999, Macao returned to China and became one of China’s two special administrative regions. After the handover, the number of universities in Macao has continued to increase. Thus, the Macao government’s financial allocation for higher education has increased year by year, and a series of laws and regulations

have been revised and improved, providing guarantees for the development of higher education in Macao.

However, according to relevant data from the 2013 “Summary report of special reading evaluation for primary and secondary school students in Macao” (Macao Education and Youth Affairs Bureau, 2013), each Macao high school graduate took an average of 3.12 entrance exams. This reflects the problem that Macao’s higher education admissions examination had different entrance examination requirements for each higher education institution before 2017, resulting in a substantial increase in the number of students taking exams. The interviewed teachers also pointed out that since there are no public examinations in Macao, in order to increase their chances of further studies, high school third-year students will take entrance exams for multiple local and overseas tertiary institutions. Starting from the second grade of high school, the focus of teaching has been on preparing students to take different entrance exams. This situation has attracted people’s attention to the reform of Macao’s higher education admissions system.

1.2. Preparation and implementation of the joint entrance examination of Macao’s four higher education institutions

In 2012, the Tertiary Education Services Office of the Macao SAR Government organized the University of Macao, Macao Polytechnic University, Institute for Tourism Studies, and Macao University of Science and Technology to set up a preparatory group to start planning for the “Joint Entrance Examination of Macao’s Four Universities,” also known as the “Joint Entrance Examination of Four Universities.” Since then, the “Four Universities Joint Entrance Examination” exam syllabus and mock test questions were announced and launched in October 2014. In May 2016, important matters such as the registration for the entrance examinations of the four universities and the dates of the joint examinations for each subject were announced. In 2017, the “Four Universities Joint Entrance Examination” system, including Chinese, Portuguese, English, and Mathematics, was implemented for the first time.

1.3. Research purpose

This study aims to use multi-source theory to conduct an in-depth analysis of the joint enrollment policies of the four universities in Macao. The specific goals include: first, to explore the theoretical basis for the formulation of this policy; second, to clarify the advantages and challenges in its implementation; and third, to analyze the impact of this policy on the future development of higher education in Macao. From the perspective of theoretical development, it is expected to enrich the theoretical system of higher education enrollment policy research; from the perspective of practical guidance, it is expected to provide theoretical support and practical suggestions for further improving the joint enrollment policy of the four universities in Macao.

2. Literature review

2.1. Reform of the college entrance examination system in mainland China

In recent years, many scholars have conducted in-depth research on the reform of the college entrance examination system, and the reform of the college entrance examination system can be examined from multiple dimensions. For example, from the dimension of reform demands, Chen and Sun (2024) pointed out that the new model of autonomous learning for high school students is the main demand of the reform of the college entrance examination system, emphasizing the close connection between the innovation of education models and the reform of the college entrance examination system. In the dimension of educational needs, Sun and Zhou (2024) interviewed secondary vocational schools and highlighted the importance of examining the reform of the college entrance examination system from the perspective of students' educational needs, especially the problems existing in the vocational education college entrance examination. In the dimension of social recognition, Huang (2024) proposed that the social recognition of the vocational education college entrance examination should be strengthened, emphasizing the great significance of social recognition to the reform of the college entrance examination system. In the dimension of problem solving, Li (2021); Li and Zeng (2020); Ning and Qiu (2020) discussed the problems and solutions in the reform of the college entrance examination system from different perspectives. In the dimension of value orientation, Ge (2021) clarified the direction and goals of the reform of the college entrance examination system. In terms of development strategy, Ge and Fu (2019), Liu (2020), and Zhang (2021) provided feasible paths and ideas for the reform of the college entrance examination system, as well as historical experience and reference for future development.

2.2. The policy significance and impact of the “Joint Admission Examination (JAE) for Macao Four Higher Education Institutions” for Macao universities

Although the “Joint Recruitment of Four Universities in Macao” policy has many positive effects, some people are concerned that it may limit the diversification of education in Macau. However, as Professor Lam Fat Iam (2013), Dean of the Faculty of Humanities and Social Sciences at Macao Polytechnic University, pointed out, there is no clear logical link between educational variety and the Joint Admission Examination. Macau has a reasonably unified examination system, and its diversity has not been lost as a result (Macao Monthly, 2013).

Ma and She (2019) pointed out that the “Joint Admission Examination for Four Higher Education Institutions” policy is the result of multiple factors. From a historical perspective, the development of higher education in Macao after the return requires exchanges and cooperation among universities. In reality, this policy came into being to ensure the quality of education, balance the diversity and uniformity of entrance examinations, and respond to public demands to reduce the examination burden on students. Its main contents include the application process being consistent with the

current entrance examination, the joint examination subjects being language and mathematics, there being no unified admission standards, and providing special arrangements for students with disabilities. The “Four Universities Joint Examination” has brought many positive effects, such as reducing the burden on students, helping students clarify their future development direction, integrating university resources, improving the entrance examination mechanism, broadening the channels for educational connection, promoting the flow of talents, expanding cooperation between institutions, and promoting the development of Macao education. However, the policy also faces some doubts, and all parties need to have in-depth discussions in the future to improve the entrance examination mechanism. Nie (2015) also believes that the “Four Universities Joint Examination” is an innovative policy. It is conducive to the development of Macao’s higher education system, saving manpower and material resources, and promoting basic education reform, but it also mentions the existing problems.

Zhang (2020) also pointed out that Macao’s higher education faces the dual challenges of unbalanced development and structural imbalance. In terms of unbalanced development, the University of Macao far exceeds other universities in terms of resource allocation, faculty strength, and scientific research results. In terms of structural imbalance, the “one industry dominates” in Macao’s gaming industry, resulting in a high proportion of business majors in higher education and weak science and engineering majors. Although this single professional setting matches the industrial structure, it is unbalanced, restricts students’ choices, and is not conducive to the development of regional innovation technology and a diversified economic society.

The “Joint Recruitment of Four Universities in Macao” policy is the result of multiple factors. This policy currently focuses on the enrollment level, and its connection with “Guangdong-Hong Kong-Macao Greater Bay Area Cooperation”, “Cooperation with Community of Portuguese Speaking Countries and the “Belt and Road” strategic development”, and “Development opportunities of the Hengqin Guangdong-Macao Deep Cooperation Zone” is not yet obvious.

To achieve a more balanced and sustainable development of Macao’s higher education, we can take the following measures. First, the government should strengthen the guidance of the balanced development of higher education, adjust resource allocation, and encourage universities to take a characteristic development path. Secondly, increase investment in science and engineering majors, optimize the professional structure, and improve the status and development level of science and engineering majors. Thus, learn from the successful experience of other regions and actively explore the path of education reform suitable for Macao. In addition, strengthen educational cooperation with the mainland and other regions, broaden students’ development channels, and enhance the overall strength of Macao’s higher education. For example, the joint enrollment mechanism will be incorporated into the overall layout of the Greater Bay Area education cooperation so that students from all universities in Macao can have more opportunities to exchange and study in universities in the Greater Bay Area, thereby strengthening collaborative cooperation in talent training. In terms of cooperation with the Community of Portuguese-speaking Countries and the “Belt and Road” strategic construction, the Macao SAR government

can focus on leveraging Macao's unique language and cultural advantages. The Macao SAR government can attract more students from the Community of Portuguese-speaking Countries and the "Belt and Road" to study in Macao through joint enrollment. This can promote academic exchanges and joint training programs between Macao's universities and universities in these countries and regions, thereby enhancing Macao's influence in international education exchanges and contributing to the implementation of relevant strategies. In order to enhance Macao students' understanding of the development opportunities of the Guangdong-Macao in-depth cooperation zone in Hengqin, the Macao government can consider how to combine the joint enrollment with the talent needs of the Hengqin Guangdong-Macao Deep Cooperation Zone. For example, according to the professional talents urgently needed by the key development industries of the cooperation zone, it can adjust the professional settings and enrollment quota allocation of the four universities' joint enrollment. It can provide high-quality talents for relevant enterprises in a targeted manner. In this way, the joint enrollment of the four universities can better serve the development of the cooperation zone and further enhance the fit with the overall development of the region.

2.3. Theoretical framework

This study will be based on Kingdon's (1984) multiple streams theory analysis. As an analytical framework, Kingdon focuses on three categories of independent (and interdependent) variables that interact to produce "windows of opportunity" for agenda setting. Kingdon (1984) viewed the policy process as a function of three streams: issues, policy, and politics. Kingdon uses the metaphor of three separate "streams" to describe the gap between policymakers' attention to the problem and their adoption of meaningful solutions (Cairney and Zahariadis, 2016).

3. Method

3.1. Methodology

This study uses Kingdon's Multiple Streams Theory as a framework to analyze the Joint Entrance Examination policy of the four universities in Macao. Multiple Streams Theory provides a useful perspective for understanding the complex process of policy making and change.

In this study, there are clear plans and arrangements for sample selection, data sources, and collection methods.

In terms of sample selection, the focus is on official documents that are closely related to Macao's higher education system. These official documents cover different types of information, such as policy documents, reports, and announcements issued by government departments, various educational institutions, and related organizations. When selecting these documents, the key basis is their relevance to the joint entrance examination policy of the four universities in Macao. Only documents closely related to the joint entrance examination policy will be included in the research scope.

In terms of data sources, it includes information provided by the official websites of government departments, educational institutions, and related organizations, and

covers relevant information stored in academic databases, as well as relevant content released by news sources. And in order to understand the entire process from the formulation to the implementation of the joint entrance examination policy of the four universities in Macao, the time span of data collection is set to a longer period from January 2000 to October 2024.

As for the data collection method, a systematic and rigorous operation process will be adopted. Specifically, it is necessary to conduct a comprehensive search and detailed review of various data sources that have been identified. In this process, researchers will use a series of keywords closely related to the joint entrance examination policies of the four universities in Macao, and use these keywords to accurately identify relevant documents that meet research needs, thereby providing sufficient and effective data support for subsequent research and analysis.

3.2. Data analysis

This study uses the multi-stream theory as the main theoretical analysis. We conduct a comprehensive analysis of the problem stream, policy stream, and political stream.

In terms of the problem stream analysis, we reviewed the collected data, aiming to accurately identify the various problems and conditions that led to the introduction of the four major joint examination policies in Macao. We hope to find the main factors for the introduction of the policy and lay the foundation for understanding the background and reasons for the formation of the policy.

In terms of policy stream analysis, we conducted a detailed analysis of the specific content of the relevant policy documents. We hope to find ways for policies to solve various problems in Macao's examination system. We studied many characteristics of Macao's four major joint examination policies, such as how to set unified examination subjects, how to specify comprehensive evaluation standards, and whether the policy is feasible at the technical level. We hope to understand the structure and connotation of the policy itself through such a comprehensive analysis and clarify its response strategies for specific problems.

In terms of political flow analysis, we conducted an in-depth analysis of the political background of policymaking and the interaction between various stakeholders. We understand the roles played by government departments, universities, social organizations, public opinion, etc. in the entire policy-making process and the political dynamics and decision-making process that affect policy-making and implementation. Through such analysis, we can clearly see the roles and influences played by different subjects in the policy promotion process and thus understand the complex mechanisms of policy formation and implementation.

3.3. Reliability and validity

We took several steps to ensure the reliability and validity of the study. We first analyzed the existing literature. This laid a theoretical foundation for the study. This helped ensure that the study was based on existing policy analysis and knowledge and research related to higher education.

To increase the credibility of the study, we triangulated our findings through multiple data sources. These data sources included official documents, news sources, and academic literature. We also cross-validated them to ensure the reliability of the findings. Although the research design and methods were designed to ensure the reliability and validity of the research findings, there are still some potential biases and limitations to consider. First, there may be limitations in the availability of our data. This may affect the comprehensiveness of the study. We mainly used qualitative analysis. This research method is somewhat subjective. To reduce this subjectivity, we asked multiple colleagues to participate in the analysis. This study is also affected by other factors. For example, the policy context may change over time, which may affect the applicability of the research results. This study needs to consider the dynamic nature of the policy environment and its possible impact on the research results.

In summary, the research method combines literature analysis, observation and qualitative content analysis to provide a comprehensive understanding of the joint entrance examination policy of the four universities in Macao through the perspective of multi-stream theory. By addressing potential biases and limitations and taking measures to ensure reliability and validity, this study aims to provide valuable insights into the policy formulation and implementation process.

4. Findings

4.1. Historical overview of Macao's "Four Universities Joint Entrance Examination" system (JAE)

The plan for the joint entrance examination (language and mathematics) of Macao's four colleges and universities stated that it should reduce the number of exams for local Macao students when selecting a university and reduce the pressure on students and parents to face the entrance exams of various colleges and universities. In consideration of this, the Higher Education Office of the Macao Special Administrative Region Government organized the University of Macao, the Macao Polytechnic University, the Institute for Tourism Studies, and the Macao University of Science and Technology to set up a preparatory group in 2012, and began to plan the "Joint Entrance Examination for the Four Macao Universities (Language and Mathematics)", also known as the "Four Universities Joint Examination". Concurrently, consultations with the Education and Youth Affairs Bureau, the Macao Chinese Educational Association, and the Macao Catholic Schools Association were held. Since then, the "Four Universities Joint examination" outline and mock test questions have been announced and launched in October 2014. Important matters such as registration for the Four Universities' entrance examinations and examination dates for each subject of the joint entrance examination were announced in May 2016. Immediately following, in 2017, the "Four Universities Joint Examination" system, which included four subjects: Chinese, Portuguese, English, and mathematics, was implemented for the first time. After reaching a consensus based on the core part of the current college entrance examination subject outlines and the principle of "seeking common ground while reserving differences", the examiners of the four Universities reformulated the examination scope.

Each test subject must meet the following conditions, according to Article 28, Item 9 of Decree No. 11/91/M: (1) Is currently enrolled in sixth grade secondary school or an equivalent course, or has completed sixth grade secondary school or an equivalent course; (2) and obtain graduation qualifications; or (3) and be over the age of 25 and have special talent conditions to take the exam. Candidates who do not have the general academic qualifications required for admission to higher education can still obtain admission qualifications after passing the entrance examination. This demonstrates the examination system's adaptability and humanity.

The "Joint Examination of Four Universities" is not a unified examination, nor is it the only way to gain admission. In order to conduct comprehensive consideration, institutions will refer to and add other considerations based on the characteristics of each institution and the requirements of the courses they are applying for, in addition to reviewing the test scores of candidates during the admission process. For example, candidates' secondary school grades, international exam results, specialties, awards received, and so on.

Furthermore, each institution will maintain its current policies regarding recommending students, exemption from examinations, and interviews. The Unified Examination is a comprehensive assessment of basic education that also serves as the high school graduation requirement. In contrast, the "Four-University Joint Examination" assesses students' ability to enter Macao's four higher education institutions. Furthermore, because the exam has no cut-off score, there is no traditional "pass" or "fail" grade standard. The admission procedures and standards are still in place: The four colleges and universities conduct admissions based on their own admission standards, and there is no "central distribution" practice or situation.

However, taking the "Four-School Joint Examination" as a middle school student is not required. Students' grades have no bearing on secondary school graduation, and they will have no impact on their participation in entrance examinations for other local institutions other than the "Four-School Joint Examination", or on their study abroad. Furthermore, even if students enroll in four colleges, they can apply for recommended admission and be exempted from taking the "Four-School Joint Examination", and they can also apply for exemption from all or part of the "Four-University Joint Examination" based on the results of their international examinations.

Despite the lack of a re-examination mechanism, the original submission system, which includes recommending students, exemption from examinations, and interviews, will be maintained. Furthermore, the "Four Universities Joint Examination" does not specify teaching materials, but it will set an examination outline and provide mock test questions as a reference.

The teachers from the four colleges are in charge of assigning and marking work, and students can apply to other colleges based on their specific needs.

4.2. Application of multi-source theory to the interpretation of the "Four Universities Joint Examination" policy

The trash can model serves as the foundation for the multi-source flow theory. In the article "The Trash Can Model of Organizational Choice", Mihacel Cohen, James March, and John Olsen stated in 1972 that organizations are basically in "organized

anarchy” and that when many people face problems, their solutions are themselves. This influences the institutional process of policy and its final outcome. Kingdon revised the trash can model further and developed a multi-source flow analysis framework. He proposes viewing the policy formulation process through three lenses: Issue source, policy source, and political source, and believes that once the policy window is open, new public policies will emerge (Sabatier, 2004).

This study will examine the policy of the “Four-University Joint Examination” from the standpoint of the multi-source theory. The study will further dissect the internal factors of the confluence of multiple sources, in order to explain why the “Four-School Joint Examination” policy has become the agenda of the Macao government.

4.2.1. The issue sources: An excessive number of entrance exams, which increases the pressure of local students

According to popular opinion, the phenomenon of multiple examinations should be addressed first

The Mainland China has the “gaokao” system, Hong Kong has the “Hong Kong Diploma of Secondary Education Examination”, and Macao did not have a corresponding unified or joint examination system prior to 2017. The long-term enrollment system of Macao’s higher education institutions is divided into two types: The independent admission examination system, in which Macao’s higher education institutions independently set up entrance examinations based on their school conditions, which can generally be divided into two parts: Written examination and interview; and the institutional admission examination system. Each middle school in Macao has a certain number of “Guaranteed Admission” students who are recommended to various colleges and universities based on their performance in their own schools. Higher education institutions either exempt them from the written test or directly admit them based on the circumstances, which is also known as the “Guaranteed Admission” system. However, under the “recommendation” system, Macao students who are “recommended” do not necessarily attend their preferred universities. To some extent, the amount of “recommendation” is a kind of “guarantee” for them. The entrance examination requirements of different Macao institutions of higher learning differ, as do the difficulty of the test papers for each institution. The students who haven’t obtained the “recommendation” qualification or those whose universities are not their top choices will all first look for an opportunity to test the “water temperature” (also known as “students will apply to several universities”). As a result, the number of students taking exams exceeds that of mainland China and Hong Kong. It is very common in Macao for high school freshmen to take two or three “entrance examinations”, if not more. According to the Macao Youth Research Association’s research report on Macao students’ perspectives on the implementation of the unified examination system, more than 80% of respondents who support the implementation of the unified examination system believe that unifying the “upgrade examination” is critical (Macao Youth Research Association, 2012).

Improving local students' examination pressure

The Macao government has vigorously implemented the “Ten-Year Plan for the Development of Non-Higher Education in Macao (2011–2020)” since its return to the motherland. Based on 15 years of free education in terms of education, vigorously reform the curriculum and teaching to promote students' overall development. Furthermore, with the popularization of education, the pressure of Macao students has sparked widespread public concern. However, the Macao government has launched a new admissions system for the “Joint Examination of Four Universities”. The battle between colleges and universities over “snatching people” has even resulted in a “theatre effect” among students. Although the current “Four-University Joint Entrance Examination” does not have a “score line”, will not be “Unified Examination”, and will not influence the candidate's school choice, I believe that no college wants to accept “scores” when they are optional. Therefore, if local candidates want to continue to study in Macau, at least one “university diploma” must first meet the “standard line” of the “Joint Examination” or obtain a higher score, which will inevitably cause A new wave of “college entrance examination papers”. Candidates must work hard to reach the “standard line”, and the candidate's alma mater will undoubtedly join the camp to assist the candidate in passing the test smoothly. A cyclical system will be formed by the “Joint Examination” system, colleges, candidates, and candidates' alma maters. The Macao government will further improve the education system in Macao through this cyclical system, and the basic ability of candidates for admission will be silently improved, thereby increasing their competitiveness.

4.2.2. Policy sources: Various suggestions and appeals in the policy

The policy community must address Macao students' demands for “burden reduction” in higher education

From a political perspective, the implementation of the four-school joint admission policy has also triggered concerns about exam-oriented education. As Professor Lam Fat Iam (2013), Dean of Faculty of Humanities and Social Sciences at Macao Polytechnic University believes that the joint examination cannot be simply associated with students' rote memorization and lack of individuality. What should be focused on is whether the joint examination, as a unified examination, promotes teaching and education in Macau (Macao Monthly, 2013).

The educational organizations, parents, and teachers have consistently expressed to the Macao government that senior high school students are overburdened with “admission exams”, which is detrimental to students' overall physical and mental development. The unification of the “advancement examination” can, to some extent, solve the phenomenon of individual admissions to higher education institutions in Macao, reduce the pressure on students to face multiple “admission examinations”, and even allow them to save money. More time to pursue personal interests and broaden your horizons. Students learn best when they are interested. It has the potential to boost students' potential and lay a solid foundation for their future university studies. In today's information age, it's also critical for students to learn how to think from multiple perspectives and how to absorb nutrients outside of textbooks, rather than burying their heads in brushing questions and becoming tool people in the exam room. Students discover their own interests and enroll in extracurricular interest

classes with close friends. These can help students' physical and mental development in areas other than academics, such as interpersonal skills, social integration, and so on. Thus, students have more time to consider their future plans. Those who want to study abroad, for example, can have more time to prepare for the IELTS or TOEFL exams; those interested in computers can also enroll in computer-related courses.

From practice exploration to the development of a multi-assessment system

The "Four Universities Joint Examination" assessment system is a practical innovation of the Macao government's examination system for assessing students in Macao. It is a new investigation into the examination of senior three students' learning outcomes. It is a self-improvement program and a supplement to Macao's educational system. A daring attempt at a unified examination and assessment system. The first "Four Universities Joint Examination" in 2017 had approximately 9000 applicants, and the number of applicants exceeded 4700. Almost 90% of recent high school graduates took the exam. There were 4748 applicants in 2018. The number of applicants for 2021 has surpassed 3800. The number of applicants for 2022 and 2021 is comparable, with 3800. Although parents and students were initially worried that the "Four Universities Joint Examination" would become the college entrance examination system in mainland China and affect their own college entrance examinations, these figures reflect the success of this system. They found that the "joint entrance examination" would not only not undermine their autonomy in taking college entrance examinations, but would solve their problem of struggling to take various college entrance examinations. The success of the 'Four-School Joint Examination' system depends on the government's persistent publicity during the policy promotion process and a good top-level design and gradual improvement of the system. All these efforts contribute to building a modern senior three education management examination system in Macao. These are the education management experience and realistic choices of the Macao SAR government since its return (Xu, 2022).

4.2.3. Political sources: Enhance the multi-assessment system and the "The Fundamental Law of Non-tertiary Education System"

Improve the multi-assessment system further

The Macao government launched the "Four Universities Joint Examination" system, which is an addition to Macao's multi-assessment system. It fully reflects the government's achievement of a balance between the "unified examination system" and the "multiple examination system," as well as the improvement of Macao's exam-oriented education situation (Xu, 2022). Education is a process in which the lives of educators have an impact on the lives of students. The education model cannot rest on its laurels in today's rapidly changing society. The global voice of education reform has not ceased in recent years. The traditional examination mode can no longer fully assess students' multiple intelligences and individual differences. As a result, "multiple assessment" has gradually become the mainstream approach. Because a diverse assessment system can effectively stimulate students' interest in learning and cultivate more new talents for the new era, it is beneficial. The Macao government has always been concerned with the education sector's suggestions and has gradually optimized the various aspects of the multi-assessment rules. The "Evaluation System

for Students in Local School Formal Education” Administrative Regulation No. 28/2020 will be officially promulgated in 2021. The regulations state in Article 3, “Implementation of Assessment,” that “it should be implemented in multiple ways, especially considering the learning process, learning objectives, learning situation, and learning environment of students, in order to understand students’ performance and learning needs in various aspects.”

However, “multiple evaluation” does not mean “indifference.” The Macao government should refer to the education reform experience in China and neighboring regions when optimizing policies, and it should also do a good job of guiding educational concepts.

Continue to improve the “The Fundamental Law of Non-tertiary Education System”

Since Macao’s return, the Macao government has paid close attention to education governance. According to Article 121 of the Basic Law, “Macao Special Administrative Region formulates its own education policy”, the Macao government issued the first legal system related to non-higher education in Macao after several rounds of consultations. In 2006, the Fundamental Law of Non-tertiary Education System was finally enacted. This “Fundamental Law” is a watershed moment in the development of Macao’s non-university education system. The Macao government values vocational and technical education as well, and has revised the non-higher education vocational and technical education system. The most recent system will be implemented on 1 September 2022. The bill ensures the long-term development of vocational and technical education, establishes a link mechanism with higher education, allows students in middle school to contact enterprises or related industries or professional groups, and formulates a curriculum framework for vocational and technical education. It also standardizes and optimizes student effectiveness in professional practice. These have significantly increased the professionalism and social acceptance of vocational and technical education. However, while Macao has approximately 78 non-tertiary education schools, only 9 of these schools offer vocational and technical education. “Macao Portuguese School”, “Technical-Professional Luso-Chinese School”, “Macao Kung Luen Vocational and Technical Middle School”, “Macao Sam Yuk Middle School” Chinese Department, “Pui Va Middle School”, “Macao Millennium Secondary School”, “Saint John De Brito School”, and “Macao Conservatory” are among the nine schools (Macao Education and Youth Affairs Bureau, 2012). Only two of them have added or created vocational and technical courses since Macao’s return. They are the “Pui Va Middle School”, which was founded in 2005. In high school, this school has added two vocational and technical courses. President Cui Baofeng established the “Macao Millennium Secondary School” in September 2003. In other words, the development of vocational and technical education in Macao has been glacial since 1999. The Macao government can begin by promoting the development of vocational and technical education in the following areas:

- 1) The education department should create a dual-track education system that prioritizes basic education and vocational technical education while also providing multiple options for further education.

- 2) The education department should begin with the “Joint Examination” system, for example, by adding computer-based exams and professional examination to the “Four-University Joint Examination” subjects, and so on.

4.3. The opening of the “Four Universities Joint Examination” policy window: A new student evaluation system based on the convergence of multiple sources

In fact, in the multi-source theory, the source of problems or the source of politics can become the government’s agenda on its own, but they cannot guarantee that only one source can enter the government’s agenda. They can only be successfully opened when multiple sources are organically combined. The “Window of Opportunity,” sparking the development of a policy agenda.

4.4. A good strategy for implementing the “Four-University Joint Examination” policy: To promote examination system improvement

When implementing the policy of joint admissions of four universities, we need to consider the setting of the examination content. As Professor Lam Fat Iam (2013), Dean of the Faculty of Humanities and Social Sciences at Macao Polytechnic University, said that the examination content should be considered from two dimensions: one is to conform to the curriculum design of Macao secondary school students, and the other is to meet the requirements of universities for cultivating talents. In the implementation of the joint admissions of four universities by the Macao government, there must be an interaction between basic education and higher education (Macao Monthly, 2013).

The pace of educational reform will not slow down. The connection between social changes and education is inextricably linked. We can see that the Macao government has been looking for a suitable path for Macao education governance. We also clearly understand that whether schools need to select students with excellent academic performance or society needs to screen qualified talents, the selection process is inextricably linked to examinations. Different people evaluate the unified examination system (such as the college entrance examination), but many people still believe that “the college entrance examination is the fairest selection of talents in life” and that the examiners only look at your test scores, not your appearance. It does not consider your family history or any of your other factors. When the Macao government improves the examination system, the following concepts must also be implemented:

4.4.1. Put the concept of reducing the number of exams for students into action

As previously stated, it is very common for high school freshmen in Macao to take two or three “entrance exams,” if not more. The purpose of the test is to assist teachers in understanding students’ learning achievements at a specific stage, as well as to allow schools to understand teachers’ teaching achievements. However, the public examination for senior high school graduates does not meet all of the above requirements. On the contrary, it makes students tired of taking the test and even abandons senior high school students’ study tasks. Reduced public examinations for senior high school graduates will have no effect on the quality of enrollment in colleges and universities, nor will it significantly alter the current “selection model”

of colleges and universities. Before they “advance to college,” fresh high school graduates must work hard to improve their knowledge level. The examination mode at their own university has not changed, and students’ learning tasks and pressures remain the same. The “Four-School Joint Examination” reduces the number of public examinations for senior high school freshmen, allowing them to concentrate more on their own school’s examination tasks. Senior high school freshmen have successfully transitioned into freshmen. Following that, they may take additional public examinations, and the “Four-University Joint Examination” may also allow them to adjust to the public examination mode ahead of time, which is more conducive to future career development.

It is for these reasons that it is very important to implement the concept of reducing the number of exams for students, and it also coincides with the concept of “burden reduction” in China’s “double reduction” policy. From the perspective of “reducing the burden” for students, it is definitely very meaningful, but to consolidate the achievements of the current “Four-School Joint Examination” policy still requires the efforts of the government, schools, and teachers.

4.4.2. Implementing the concept of multi-education and multi-enrollment in Macao’s higher education institutions

“The Macao Special Administrative Region formulates its own education policies, including policies on the education system and management, teaching language, allocation of funds, examination system, recognition of academic qualifications and degrees, and so on, to promote the development of education...” (Legal Affairs Bureau, 1993). As a result, how does the Macao education system match the social and economic development of Macao? How to cultivate talents suitable for Macao’s development, but also how to maintain the diversity of school running, recruitment, teaching, culture, and the school system? The multi-assessment system, and so on, have always been issues that the Macao government has to consider in system-related policies. When the Education and Youth Affairs Bureau released the “Macao Education System Amendment Proposal” in 2003, it was clear that students should be at the center (Education and Youth Affairs Bureau, 2003). Later, in “The Context of Educational Reform,” he stated that the four major concepts of educational development in Macao are “Education for All, Lifelong Learning, Diversified Development, and Quality Improvement,” with quality improvement being the core concept among the four (Su, 2003).

“All types of schools in Macao can continue to operate,” according to Article 122 of the Basic Law of Macao. In accordance with the law, all types of schools in the Macao Special Administrative Region have the autonomy to run schools and enjoy teaching and academic freedom. The Macao Special Administrative Region can continue to operate all types of schools. Outside of the administrative area, recruitment of teaching staff and selection of teaching materials take place. Students have the freedom to study at institutions outside of the Macao Special Administrative Region. Legislative Affairs Bureau (1993) The aforementioned provisions took into account Macao’s unique historical and cultural background and laid the groundwork for the diverse development of education following Macao’s transformation. The most important are the school system, language teaching, admission to higher education,

school administration, and textbooks. The characteristics of Macao's educational diversity. The multi-educational system in Macao means that, in addition to the legally mandated 3 + 3 schooling system, there are other schooling systems in Macao, such as the Portuguese schooling system of Portuguese schools, the Canadian schooling system of Macao International School, and so on. Because of the diversity of teaching in Macao, some schools, such as Sacred Heart English Department, Canossa Girls High School English Department, Yuehua English Department, Salesian Secondary School, and others, teach in English in addition to Chinese. They will create their own teaching materials, and some public schools, such as Sino-Portuguese Vocational and Technical School, Comes Sino-Portuguese Secondary School, and others, will make Portuguese a required course. This reflects the characteristics of Macao's various schools and textbooks (Yang, 2006).

According to the Macao Education and Youth Affairs Bureau's "Survey Report on the Situation of School Leavers in the 2018/2019 School Year," there are 704 students studying or emigrating abroad. This reflects the benefits of Macao's educational diversity. Macao is a small area with few people, and the disciplines are limited. If there is no such pathway to higher education, it may limit the development of Macao's diverse talents in the future (Macao Education and Youth Affairs Bureau, 2020).

Improve the student assessment system so that students have sufficient knowledge reserves and "burden reduction" to strike a balance in the university's learning process.

4.4.3. Analysis and improvement of the examination system based on educational big data

The "educational big data" has significant impacts on both the examination system and the broader field of higher education. In Macao, where a strong emphasis is placed on educational innovation and improvement, a comprehensive education big data platform has been established to further harness the power of educational data. This platform can be utilized to enhance the entire education system.

The different types of classification methods for educational data form the basis for the structural model of educational big data. It can be mainly divided into: base layer, state layer, resource layer, and behavior layer.

The structural model of educational big data can provide a clearer understanding of the general situation of educational big data. This study constructed the structural model of educational big data as shown in **Figure 1** below. Overall, education data can be divided into four layers, from the inside to the outside: the base layer, state layer, resource layer, and behavior layer. The base layer refers to storing government education basic data.

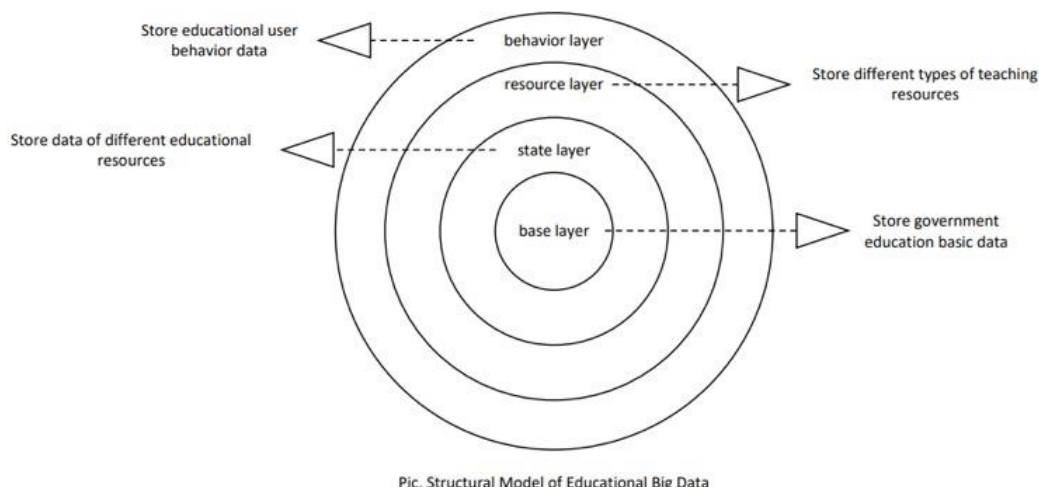


Figure 1. Structural model of educational big data.

The state layer refers to storing data of different educational resources. Resource layer refers to storing different types of teaching resources. The behavior layer refers to storing educational user behavior data. The base layer includes the basic data of government education, such as school information, educational statistics, etc.; the state layer includes different types of teaching resources, such as the situation of teaching equipment, teaching progress, etc.; the resource layer includes different teaching in the educational process. The educational resources, such as textbooks, PPT courseware, micro-classes, teaching videos, pictures, games, teaching software, test questions, etc.; the behavior layer includes behavioral data of educational users (teachers, students, educational administrators, etc.), such as learning behavior data of students, teachers’ teaching behavior data, etc.

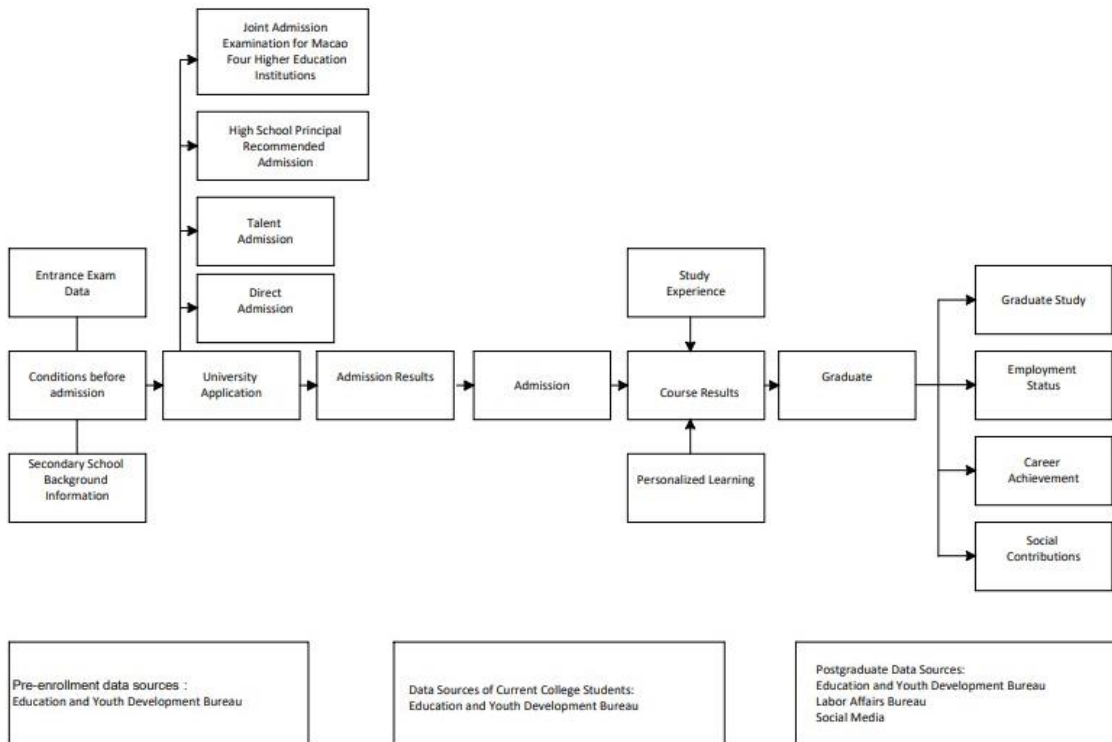
The main collection and generation methods and application scenarios of different layers of educational data are also different (see **Table 1** below).

Table 1. Comparison of educational big data collection methods and application scenarios.

Data hierarchy	Data collection method	Method description
Base layer	Educational basic data collection	Macroscopically control the status quo of education development, scientifically formulate educational policies, rationally allocate educational resources, and improve the educational examination system, etc.
State layer	Manual recording of educational environments	Intelligent management of education, environment, etc.
Resource layer	Teaching resource construction	Optimize teaching tools
Behavior layer	Teaching log recording	Personalized learning, learning path and teaching behavior prediction, etc.

4.4.4. Basic elements and integration paths of big data in higher education

Figure 2 shows the construction path of education big data in Macao. The data comes from the Education and Youth Development Bureau, the Labor Affairs Bureau, and social media.



Pic.2 Basic Elements and Integration Paths of Higher Education Big Data

Figure 2. The number of people participating in Macao JAE in recent years.

A big data platform for student development paths, including basic education, university education, employment, the economy, demographic characteristics, and social contributions in Macao. Through this platform, the Macao government can comprehensively study and summarize the growth characteristics and laws of college students, explore the advantages and disadvantages of higher education in Macao, and analyze the fairness of higher education and the impact of higher education on social and economic development, as well as the impact of higher education, value, and contribution of graduates to society. Therefore, the research results can provide a basis for the Macao government to formulate basic education and higher education policies, and it is also one of the main bases for the Macao government to formulate higher education policies and higher education budgets.

5. Conclusion

The “Joint Recruitment of Four Universities in Macao” is a policy driven by multiple factors. It has a positive impact on reducing the burden on students and promoting educational development. However, Macau’s higher education currently has problems of unbalanced development and structural imbalance. The Macau government can consider incorporating the joint examination mechanism into the education cooperation in the Guangdong-Hong Kong-Macao Greater Bay Area. Because this can allow Macau to play its language and cultural advantages with Portuguese-speaking countries and allow Macau to play the institutional advantages of “one country, two systems” in the “Belt and Road” cooperation. Thus, the Macau government can also allow Macau’s higher education curriculum to meet the talent

needs of the Hengqin Guangdong-Macao Deep Cooperation Zone. All of these can enable the sustainable development of Macao's higher education.

The study of "Specialized Reading Assessment for Primary and Secondary School Students in Macao" played a vital role in the formulation of the "Four Universities Joint Examination" policy and reflected the scientific governance ideas of the Macao SAR government.

This study has several important contributions: First, it provides a solid policy basis for policy evaluation to formulate more comprehensive and targeted examination policies to meet the special education needs of Macao students and improve the local examination system. Second, it analyzes why Macao has not opened a policy window like the mainland college entrance examination or the Hong Kong diploma system and deepens the understanding of the complexity of education policy formulation and implementation. Third, it has insight into the impact of examination reform and reveals the close relationship between the unified high school examination model and the "output" of basic education and the "input" of higher education, which is conducive to the formulation of more effective reforms.

For the current policy, the implementation of the "Four Universities Joint Examination" is a step towards a more unified examination model. In the future, the government needs to continuously monitor and adjust policies to create an examination model suitable for Macao. Thus, this study suggests cutting off the connection between student performance and teacher achievement, which can improve teaching quality. Combining examination content with future needs can better prepare students for higher education and careers.

For future research directions, researchers can conduct long-term follow-up studies on students. The purpose is to understand the impact of policies on their development.

Our specific policy recommendations are that the government can strengthen policy communication with schools, parents, and students. We hope that the government can ensure that all stakeholders are aware of the policies. We hope that researchers can explore the government's work on continuous evaluation and feedback mechanisms in the future. The purpose is to ensure that policies continue to be effective. In conclusion, this study has made an important contribution to the understanding of Macao's education examination system and provides a roadmap for improving the education system.

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