Cultivating Innovative Talents in Chinese Universities: College Students’ Perceptions of Innovative Thinking and Implied Policy Effectiveness

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I. Introduction

For the past few decades, the Chinese Communist Party (CCP) has aggressively pursued the modernization of technology and human capital to promote economic growth.¹ Before the 1980s, the CCP focused on training students in very narrow specializations to fill job plans designed by the government.² With the transition into a market economy in 1980s, however, the rapidly changing needs of the labor market compelled the state to develop a more competitive and adaptive labor force. As a result, the CCP broadened its pursuit of scientific advancement to that of general innovative capabilities. By breeding innovation, the government strives for not only domestic economic success but also sustainable, above-world-average economic growth. In discussing the Chinese economic development scheme, Shen Xiaobai echoed the importance of innovation:

If Chinese producers and consumers follow the trends of those in the industrialised countries, China will always be a step behind. Regardless of how quick learners they are, Chinese companies will have little chance to overtake, or even catch up with, the established competitors in the industrialized world, who are already leaders in the market and who know the market better.³

The strategic nature of the pursuit hints toward selective and targeted investment. Indeed, the previous minister of education in China, Zhou Ji,
explicitly acknowledged the importance of imbuing China’s future labor force—college students—with innovative thinking abilities for developing a knowledge economy. Given the importance of cultivating innovation and the government’s heavy investment in higher education, it is important to examine the effectiveness of current government initiatives. That is, has the Chinese government been successful in promoting the formation of innovative thinking?

While this question can apply to all countries with similar pursuits, it is particularly interesting in the case of China. As I will define more thoroughly, innovative thinking often entails independent thinking and creativity, which refer to thinking with autonomy and without boundaries. These implications, in turn, seem to contradict the authoritarian nature of the Chinese Communist Party. In other words, can non-democratic political regimes effectively foster innovative talents through appropriate investment in universities?

This research indirectly explores these questions by studying Chinese college students’ perceptions of the effectiveness of higher education policies. Subsequent literature review provides background information on policy formation, implementation, and results, which collectively establish a framework for understanding the remaining challenges in developing innovative talents and the contribution of this research.

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II. Literature Review

Policy Formation

The Ministry of Education (MOE) emphasizes the important role of universities in cultivating innovation in several policy documents. The “Higher Education Law of People’s Republic of China” (zhonghua renmin gongheguo gaodeng jiaoyu fa) stipulates that the purpose of higher education is to train talents possessing innovative spirit, implementation skills, and specialized knowledge.5 Similarly, in the “Action Plan for Education Revitalization for 2003 to 2007” (2003 zhi 2007 nian jiaoyu zhenxing xingdong jihua), the MOE unequivocally defines universities as a base for solving economic, technological, and social problems for local communities and the nation.6 Additionally, the policy document stresses the dedication of resources to high-level innovative talents (gao cengci chuangzaoxing rencai), a term that refers to young scholars enrolled in undergraduate or postgraduate studies. No other categories of students are mentioned in association with innovative talents, which indeed implies the government’s prioritization of higher education in cultivating innovation.

A third document, which focuses on compulsory education, also reflects this trend. In the “Compulsory Education Law of People’s Republic of China” (zhonghua renmin gongheguo yiwu jiaoyu fa), the MOE states that teaching should be tailored to students’ characteristics and dedicated toward nurturing

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independent thinking abilities and innovative capabilities. As noted several times in the policy document, however, the primary focus of K-12 schooling is moral discipline (deyu). We can infer from these documents, then, that innovative thinking is a beneficial yet subordinate pursuit of the government at the compulsory education stage. Therefore, a focus on higher education for examining the effectiveness of government investment is more appropriate.

Several projects were initiated as a result of the pursuit. The creation of world-class universities, a pursuit parallel to innovation development, is generally considered to have begun with the 211 Project in 1995. The 211 Project refers to a program that builds up 100 higher education institutions (HEIs) and a number of key disciplines in the 21st century. A total investment of 36.8 billion yuan was made over the next 10 years across 99 universities, and funding supported discipline development, infrastructure building, faculty improvement, and public service system creation. In 1998, Jiang Zeming, Chairman of People's Republic of China (PRC), announced that “China should have several advanced world-class universities to achieve modernization,” which signaled an impending concentration of resources on a smaller number of universities. Indeed, the MOE released the “Action Plan for Revitalizing Education of the Twenty-First Century,” known as the 985 Project, in which 39 universities were selected to receive funding from the central government (and local governments in some

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cases) over the course of 13 years. In particular, Beijing University and Qinghua University each received 1.8 billion yuan, or 60 percent of the total funding allocated to research universities under the project. The mission was to further China’s scientific development and knowledge creation in “important industries,” which were not specified.

Two features are worth noting. Out of the thirty-nine 985-Universities funded, 15 specialize in sciences, 20 are comprehensive universities, and only 4 universities specialize in non-science fields. The government’s preoccupation with scientific advancement is also reflected by the repetition of the phrase in the policy document. By linking the development of innovative thinking to the eventual goal of scientific breakthroughs, the government sets science and technology as the center of practical innovation.

Financial support from the government comes with regulations. According to a policy document titled “Opinions About Higher Education Undergraduate Teaching Quality and Reform” (gaodeng xuexiao benke jiaoxue zhiliang yu jiaoxue gaige gongcheng), the MOE outlines several expectations. On the macroscopic level, the funding should be used to improve research facilities and promote projects that are capable of fundamentally and holistically guiding students toward growth. More concretely, the MOE advises HEIs to take the following actions: 1) establish quality standards; 2) broaden the selection of majors; 3) develop experimental courses; 4) consolidate lab resources; and 5) train faculty.

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First, the government asks provincial governments to collaborate with universities to jointly determine standards of measuring education quality. Second, universities should broaden the range of majors offered to train talents for emerging industries, such as forestry, petroleum, hydro-electric, and geology. In addition, universities should select a few majors for extensive reform in the realms of faculty training, curriculum, teaching methods, and administrative management style to set role models for future full-scale reform. The third criterion stipulates that universities should initiate a series of innovative, high-quality courses, labeled “exemplary courses,” to be shared with other institutions online. These courses can experiment with unique teaching methods, recent findings in corresponding fields, and diverse teaching formats. The fourth requirement is that universities consolidate their lab resources into a select few, fully-equipped research centers that accommodate diverse research directions and enjoy extensive collaboration with industries, businesses, and other social sectors. Lastly, the government is responsible for training faculty to adopt new teaching methods and implement reform.

Two statements in the document are revealing. While the entire document stresses the ultimate goal of sharpening college students’ scientific research abilities, it also mentions projects dedicated toward entrepreneurship, humanities, and the creative arts. Resources for the latter group, however, are provided only in the form of projects and the brevity of the announcement suggests that, while the government acknowledges the existence of other forms of innovation, its primary focus remains science and technology.
Despite its encouragement of the development of high-potential disciplines, the MOE closely monitors concentrations offered at the undergraduate level. Stated in “Rule for Setting Undergraduate Concentrations at Higher Education Institutions” (gao deng xuexiao benke zhuanye shezhi guiding), all universities in China need to manage and adapt concentration offers to the needs of national economic construction, technological advancement, and societal development. Specifically, the MOE has the authority to compel the removal of a concentration if teaching quality, research facilities, or employment rate pertaining to the major falls below standards. This policy is effective irrespective of government funding, and its tone suggests not only sovereignty but also an emphasis on solid results.

Optimization of resources hence arises as a unifying theme of these policies. The 211 and 985 Projects select the best universities for heavy financial investments; majors related to emerging technologies are allotted more freedom with experimentation; and remaining concentrations are subject to close supervision. Given the high expense of higher education, it is inexorable and therefore understandable that the government dedicates more resources to candidates exhibiting the most potential—those at the best-ranking schools. As a result, cultivating innovative thinking is likely not intended for the entire student population. Students’ perceptions of top-down policy implementation may differ by university and major, a factor taken into consideration in the survey design.

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Policy Implementation at the University Level

While these policy documents signify the central government’s control over HEIs, it is important to understand the nature of the state-university relationship and how strictly universities follow the government’s instructions. Two schools of thoughts exist on this topic. One is idealism, which defines a university as a center of independent thinking, criticism, and creativity, and a community governed largely by its members. The other extreme is realism, which regards the university’s institutional policies as being shaped by external pressure from the state, business, and society. After juxtaposing these ideologies, Pan Su-Yan argues that the Chinese model is more closely associated with realism. Before reaching a conclusion, we need to examine the context in which strong state control was formed.

Historical developments have a significant influence on the contemporary state-university relationship. Two proverbs illustrate this. First, there is a Chinese saying that “being an official succeeds being an excellent scholar” (xue er you ze shi), which describes the path of selecting and promoting scholars to become government officials. While this phenomenon does not imply that the government enforces certain rules in academia, it does suggest that scholars’ pursuits and expectations are partly shaped by changes in the government’s attitudes. Another proverb, “Chinese knowledge is the root while western knowledge is for use” (zhong ti xi yong), reinforces the concept. The proverb itself

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15 Pan, *University Autonomy, the State, and Social Changes in China*, 20.
does not allude to the nature of the state-university relationship, but it suggests that the government defined the use of Chinese higher education for both economic and political purposes in national development.\(^{16}\)

Intellectuals also desired to serve the state’s goals. Cai Yuanpei, an influential scholar who returned to China after overseas studies and became the president of Peking University in 1916, considered the standard of knowledge and technology in universities to be an indicator of national strength.\(^{17}\) While desiring to help advance China’s international status, Cai did not advocate for state control. He stressed that scholars should administer universities so that they remained institutions for advancing knowledge and pursuing truth rather than becoming a political tool.\(^{18}\) In other words, universities should serve in the state’s interests without sacrificing the freedom of exploration.

Considering both historical influences and the central role of the government in building universities, it is reasonable to conclude that the CCP exerts substantial control over universities. More accurately, the MOE exercises reasonably strong and centralized control over the higher education system—a system in which university autonomy is acceptable only when it benefits the nation’s economic agenda and does not challenge the political and ideological basis of the state.\(^{19}\) Even with a recent decline in government control, the CCP retains strict surveillance over universities through resource allocation, program

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\(^{16}\) Pan, University Autonomy, the State, and Social Changes in China, 21.

\(^{17}\) Pan, University Autonomy, the State, and Social Changes in China, 24.

\(^{18}\) Pan, University Autonomy, the State, and Social Changes in China, 24. Originally from Gao, 1992.

\(^{19}\) Pan, University Autonomy, the State, and Social Changes in China, 63.
approval, project evaluation, campus visits, and regular meetings. As a result, policy implementation generally adheres to the government’s expectations.

Defining Innovative Thinking

As stated earlier, this research intends to gauge Chinese college students’ perceptions of policy helpfulness and potential gains in innovative thinking abilities. As a result, a meticulous definition of innovative thinking (chuangxin siwei), which is critical in measuring objective gains in innovative thinking, is not pursued. That said, it is important to understand the core, generally undisputed elements of innovative thinking for two reasons. First, the term is closely associated with two other terms: creativity” and critical thinking.” Understanding the relationships between these terms can inform diction in survey and interview design. More importantly, knowing what constitutes innovative thinking can help with analyzing the effectiveness of specific reform initiatives, which in turn strengthens our ability to evaluate whether government funding can yield anticipated growth in innovation.

Several scholars argue that critical thinking (pipanxing siwei) is an essential component of innovative thinking. Although there are numerous debates on the indicators of critical-thinking abilities, several aspects are mentioned in most accounts of critical thinking: ability of undertaking logical, unbiased inquiry; an attitude of being disposed to thoughtful considerations; and knowledge of the subjects under investigation.

Edward Glaser details the first dimension. The ability of undertaking logical inquiry, he argues, involves a persistent effort to examine any belief or supposed form of knowledge in the light of the evidence that supports it, recognize the existence or non-existence of logical relationships between propositions, and draw warranted generalizations.”\(^{21}\) Put differently, critical thinking requires an objective evaluation of opposing ideas and integrated analysis of a diverse range of evidence to draw convincing conclusions.

An inclination to think critically is equally important. Richard Paul argues that ability is insufficient in forming the habit of thinking diffusively. One must develop intellectual values to desire critical thinking, which in turn requires educating the whole person.\(^{22}\) Based on these arguments, effective cultivation of critical thinking needs both the capability and the inclination to think logically and holistically, and these two traits seem applicable to the cultivation of innovative thinking.

The third trait—knowledge of certain subjects—is much more controversial. Some scholars endorse it as a necessary component of critical thinking. John McPeck, for example, argues that an effective thinker in one area is not necessarily an effective thinker in all other areas...because the knowledge and skills required for one activity are quite different from those required for the other.”\(^{23}\) This argument has two implications. First, knowledge of a subject is a necessary basis for any meaningful critical thinking. In addition, critical thinking


is a discipline-specific quality rather than a transferable skill. This notion is repudiated by other scholars. Harvey Siegel counteracts McPeck’s argument by stating that “distinct acts or episodes of thinking...may have all sorts of features in common....[Moreover], skills such as identifying assumptions, tracing relationships between premises and conclusions, and identifying standard fallacies, do not require the identification of specific subject matters.”

Contrary to McPeck, Siegel believes that critical thinking does not have to be subject-dependent and, more importantly, there are transferable aspects of critical thinking that enable the teaching of it to occur in any setting.

At first glance, these two arguments seem hard to reconcile. When we attempt to apply them to the definition of innovative thinking, however, it becomes clear that both can help to define the term. After all, critical thinking is not equivalent to innovative thinking. The latter stresses not only a rigorous thinking process but also the emergence of new ideas. The emphasis on “new and better” makes knowledge of existing solutions in a field an almost indispensable element of productive innovative thinking. On the other hand, acknowledging the importance of knowledge in cultivating innovative thinking does not imply a rejection of the transferability of such skills. Innovative thinking relies on the use of knowledge but can be cultivated in any subject. In other words, students can integrate general critical thinking methods with knowledge and skills pertaining to a subject to generate innovative ideas. In the context of this research, then, the definition of innovative thinking incorporates mastery of methods of logical inquiry, knowledge of problems at hand, and inclination to undergo critical

Critical thinking is only one of the building blocks of innovative thinking. As mentioned, it does not stress creation, an essential element of innovation, and therefore cannot complete the definition of innovative thinking. This is where creativity can fill the void. Creative thinking (chuangzaoxing siwei) focuses not so much on evaluating divergent ideas but rather on overcoming existing boundaries to construct new, liberated thoughts. Therefore, creative thinking can be seen as both a complement to and an extension of critical thinking: it engenders new ideas as a result of critical reflection upon existing paradigms. Given that innovation puts new ideas to use, the only missing component after combining critical and creative thinking is applicability. Maureen Stout astutely captures the interconnection between three components:

Imagination allows us to hypothesize about what is possible; critical thinking helps us reason through those possibilities, and evaluating both helps us assess the quality of those processes and tells us whether our hypothesizing and reasoning are directed toward productive ends.25

In other words, innovative thinking refers to a result-oriented generation of new ideas based on critical evaluation of all possibilities within and beyond existing systems.

In designing survey and interview questions for this research, the terms "innovative thinking” and "creative thinking” are used interchangeably for three reasons. First, the Chinese term for "critical thinking,” pipanxing siwei, has a slightly negative connotation. That is, the term implies a certain degree of

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criticism in the process of evaluation. Since this research only intends to gauge students’ attitude toward a neutral, specific mode of thinking, the term “critical thinking” was avoided. Second, the Ministry of Education seems to equate the two terms by using both to describe capabilities related to science and technologies in some policy documents. This speculation is confirmed by Anna Hui and Sing Lau, who document that “in mainland China...creativity is synonymous with scientific and technological innovation and invention, which is quite similar to the situation in Australia.”

Most importantly, a loose definition of innovative thinking in survey question design is consistent with the central purpose of this research. The overarching research question is whether students believe they have benefited from current government initiatives toward developing innovative thinking abilities. Since this research treats policy effectiveness as its ability to bring about positive changes of any magnitude, perceived progress in any of the sub-components of innovative thinking would imply the effectiveness of top-down initiatives. More specifically, this research attempts to examine policy effectiveness in two aspects: whether policies are translated into the kinds of resources that facilitate innovative thinking habits, which are labeled “motivators,” and how important these motivators are in shaping student’s attitudes toward innovative thinking compared with other factors that are not directly affected by higher education policies.

Implementation Results from the Government’s Perspective

The government measures results in both quantitative and qualitative dimensions. Some quantitative results show significant progress. One indicator is the number of research articles published by Chinese universities in journals included in the Science Citation Index (SCI), an internationally recognized indicator of the quality of science research findings.\(^\text{28}\) According to a report issued by the MOE, the number of articles approved by the SCI for all universities under the 985 Project grew by as much as 10 to 20 times. For example, Beijing University published 2,693 articles between 1989 and 1998, which grew to 25,516 between 1999 and 2009. In addition, the MOE states that research quality has improved. Changes in the quality of publications are measured by the number of times an article is cited; the more frequently an article is cited, the more authoritative it may be. That number also grew for all 985-Universities even though it was still below that of universities in other countries, such as the United States and Japan.

Invention patents are another indicator of technological innovation capabilities. The 985-Universities produced fewer than 400 patents in 1999, with an increase to 6,000 in 2008. This number represents more than a tenfold increase in 10 years and almost one tenth of all invention patents in China that year.\(^\text{29}\) Judging from both patent registrations and research outputs, it seems that the reform has been successful in raising students’ capability to achieve innovation breakthroughs.


\(^{29}\) Ying, “Reflection on the Effects of the 985 Project,” 25.
While the statistics confirm universities’ growing strength in producing scientific findings, they are not proof of students’ innovative capabilities. After all, most scholars who publish in SCI-recognized journals are faculty members or graduate students; it is extremely rare to see undergraduate students’ work in these journals. Therefore, such statistics do not necessarily reflect policies’ impact on college students. Furthermore, not all statistics confirm universities’ improvement in innovation. Ying Cheng points out that there has been no significant increase in the annual number of publications from the 985-Universities in *Nature* and *Science*, two internationally renowned scientific journals known for consistently publishing cutting-edge research.\(^\text{30}\) Aggregating these quantitative findings, we cannot yet conclude whether current policies have facilitated the growth of innovative talents.

Nonetheless, individual universities provide another set of statistics to demonstrate the effects of policy implementation. A case study of Huazhong University of Science and Technology suggests that 985-Universities have used government funding for faculty improvement and course development. The official website of the University states that the school provides 94 majors for undergraduates, 7 of which rank as “First-Level Nationally Important Subjects” and 15 of which rank as “Second-Level Nationally Important Subjects.”\(^\text{31}\) The university also constructed numerous labs, 5 of which rank as “Nationally Important Labs” and 1 of which ranks among “Important Labs for National Security.” In terms of faculty quality, the school has established cooperation


with over 100 HEIs throughout the world and secured over 1500 foreign scholars to teach and conduct research at the university on a short-term basis. A similar study of Sun Yat-Sen University confirms the observation that 985-Universities utilize funding to improve lab facilities, faculty exchanges, and subject offerings. In addition, the website shows that the university has developed experimental courses that rank among “National-Level Exemplary Courses” and “Provincial-Level Exemplary Courses.” Given the emphasis on rankings, which are established by the central government, the achievements of at least some 985-Universities seem driven by government expectations and framed largely by government standards.

Two more insights arise from the data. First, these universities stress improvements in quantifiable, tangible aspects. Expansion in course and major offerings as well as upgrades in research facilities can be easily measured. In contrast, more qualitative aspects such as faculty teaching quality were not discussed in depth because criteria for measurement are subject to debate. Instead of describing what they have done to strengthen domestic faculty’s teaching effectiveness, universities gloss over the topic by simply mentioning the number of foreign scholars who temporarily joined their teaching force. In addition, quantitative analyses only speak about what resources are provided. It is not clear how these resources are received by students and to what extent they are utilized to stimulate innovative practices. As a result, it is difficult to tell whether policy

implementation has had a significant impact on students’ innovative capabilities.

Indeed, the government acknowledges the difficulty of assessing the quality of its policy implementation. In a report titled "Quality Report of the First Batch of 985-Universities in Shanghai" (shanghaishi 985 gaoxiao shoufa benke zhiliang baogao), the MOE recognizes that the quality reports issued by individual 985-Universities discussed the merits of the project without acknowledging potential problems and outlining plans of improvement. The MOE report mentioned several shortcomings. The first area in need of improvement is to establish a uniform standard of evaluating teaching quality.” While some schools focus on classroom teaching, others take into account aspects of student life. Without a uniform standard of quality, the government cannot identify systematic contributors to innovative talent cultivation and thus re-channel funding to maximize return of investment. More importantly, the report alludes to the fact that neither the government nor the universities thoroughly understand students’ needs and whether the resources they provide can fill the gap. The report disclosed one student’s response: “Xiao Cheng thinks that while reducing the size of classes certainly helps improve class atmosphere, it does not immediately result in improvement in learning quality because students are still under tremendous academic pressure. Given that many students have to take 12 to 13 courses per semester, it is inevitable that they cannot spend too much time on each of the courses regardless of how well it is taught.” This example, along with earlier findings, reinforces the need for a systematic examination of student

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perspectives to more accurately gauge policy effectiveness.

**Remaining Challenges**

Besides the challenge of measuring policy effectiveness, higher education in China presents other difficulties that might interfere with innovation cultivation. This section discusses three categories of obstacles: learning atmosphere, faculty-student relationship, and institutional design.

First, the learning atmosphere in many universities is not conducive to the formation of independent thinking. Academic dishonesty is one such aspect. Ren Kai, a researcher on ethical issues in education, stated that “cheating on examinations has long been a headache for Chinese university administrators and harsh penalties were used to cope with plagiarism.”

While these penalties might warn students away from cheating, they are not always strictly enforced. Ren’s interviews with Chinese college students found that teaching fellows frown upon projects in which students claim others’ ideas as their own but refrain from reporting these incidents to avoid the trouble of dealing with the aftermath.

These incidents show that the act of plagiarism is not always properly punished to preempt future plagiarism. Constant plagiarism, in turn, may deprive students of the opportunities to practice independent thinking, a necessary element of innovative thinking. While the impact of plagiarism is examined in depth in the following chapters, existing research supports the speculation that academic cheating might discourage the development of innovative thinking.

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Absenteeism is another problem. One reason is that absence from lectures deprives students of the opportunities to interact with professors and reinforce their understanding of class materials. A relatively weak grasp of knowledge, in turn, makes the development of innovative thinking difficult. Furthermore, absenteeism is often associated with apathy toward learning. The majority of the students who regularly skip classes may lack diligence or interest in what they are learning. According to Du Ruiqing, tardy college students slackened their efforts and became complacent with mediocre results. In some universities, absenteeism even reached 35 percent. If absenteeism insinuates indifference, innovative thinking—which is built upon a passion for critically analyzing the topic at hand—can fail to materialize.

Faculty faces other problems such as the lack of training for higher education teachers. Several scholars point to the shortage of funding for teacher training. There are two kinds of higher education teacher-training organizations: non-normal training centers and normal universities (shifan daxue). Non-normal training centers are equipped with high-quality teachers and curricula to provide teacher training but are compromised by financial resources. Normal universities face the opposite problem. While they guarantee the accommodation, financial support, and material resources for teacher training, their ability to provide an advanced level of training is limited by the strength of their teachers

and the rigor of the curriculum. Given that normal universities comprise the majority of higher education teacher-training institutions, a lack of qualified trainers is an urgent problem. The rapid expansion of college enrollment, including that at normal universities, is not accompanied by a proportional increase in the size of faculty. This has led to a high student-teacher ratio and strained training quality.\textsuperscript{41} On top of an insufficient quantity of trainers, the content of training is designed to satisfy the identical component of training needs and largely ignores individual teachers’ development objectives. In other words, teachers usually leave their training with inadequate skills in research and teaching pertaining to their specialties.\textsuperscript{42} Based on these observations, current teacher training is not favorable for cultivating innovative talents for two reasons. First, if lecturers are not equipped to offer educated feedback to students who are exploring advanced knowledge, they might not be able to help students develop innovative thinking skills. More importantly, identical teacher training might breed conformity. Given that innovative thinking advocates a breach from existing paradigms, it is unclear how college students can benefit from conformity-centered teaching methods in developing innovative talents.

Besides inferior training, higher-education teachers also face other problems. In a questionnaire designed by Lu Hanling, 85 percent of the surveyed lecturers at 7 universities in Guangzhou reported one of the following to be a major problem they currently confront: a lack of opportunity to improve their

\textsuperscript{41} Xu, Yang, and Yu, “The Future Reform and Development of Higher Education Teacher Training in China,” 25.
\textsuperscript{42} Xu, Yang, and Yu, “The Future Reform and Development of Higher Education Teacher Training in China,” 27.
skills, low income, and relatively poor work environment.\textsuperscript{43} The first component echoes low-quality teacher training. The other components, however, imply a need for additional sources of income outside of university teaching. Indeed, the same study by Lu revealed that 53.4 percent of the lecturers either have or previously worked at a second job. The reasons that most lecturers give for having second jobs are “it gives full play to my strengths, enabling me to realize my self-worth” and “my income is too low and I am under great financial pressure.”\textsuperscript{44} Putting aside the impact of second jobs on lecturers themselves, diverting time away from school and thus students might reduce students’ opportunities to engage with professors in academic inquiries. If the acquisition of innovative thinking relies heavily on guidance from more knowledgeable people, the unavailability of lecturers may have a negative impact on innovation cultivation.

Faculty members may also lack time due to the sheer number of college students. Funding for universities is partly used to build new campuses to accommodate larger enrollment. The size of the faculty, however, does not always increase in proportion to the new size of the student body. As a result, faculty members are often shared among different campuses of a university. As soon as such teachers finish lecturing on a new campus, they rush back to their old campus, where their offices and colleagues are located.\textsuperscript{45} As a result, a substantial portion of students do not have the opportunity to exchange ideas with


\textsuperscript{45} Pingyuan Chen, \textit{Da Xue You Jing Shen} (Beijing: Beijing University Press, 2009), 166.
professors after class or receive individualized feedback. Assuming that thinking is carried out beyond classroom, this lack of interaction may dampen students’ ability to generate and test novel thoughts toward productive ends.

Even if faculties have the time to accommodate a high level of student involvement, they may not have the ability to undertake such initiatives. Allowing students to raise challenges and questions implies that a faculty member is either capable of responding to inquiries deeper than what is taught in class or willing to discuss as students’ equal. Berenice Bleedorn summarizes professors’ general attitudes toward creative courses:

Courses in creativity require the professor to surrender the position of authority to assist students in releasing their creative ability. They also require the encouragement of a high level of student involvement, an attitude of flexibility, playfulness, and the enthusiastic commitment and belief in the concept that everyone possesses a creative ability. These requirements may not fit the style of some faculty members.46

Because not all faculties are ready to accommodate students’ explorations, college students may experience differing levels of encouragement toward innovative thinking depending on whose classes they happen to take.

The last category of challenges concerns institutional actions. While the state has implemented several measures to raise higher education quality, little is known about progress in this area. For example, many universities started administering undergraduate teaching assessments in the hope that the results would encourage faculty to improve their teaching quality.47 Shen Yushun argues, however, that while the idea of using undergraduate teaching assessment


is well-intentioned and theoretically sound, in reality, it succumbs to government manipulation and pressure from external forces. According to Shen, few faculty members pay attention to student assessments, which defeats the purpose of this practice.

What university administrators do pay attention to, argues scholar Xiong Bingqi, is their personal career advancement. According to Xiong, government officials consider the position of university president to be a stepping stone toward promotion, which leads them to seek opportunities to serve in such post. In other words, students have little influence on administrators’ career outlook, and incentives for reform generally come from above. The desire for promotion in turn prompts leaders to strive for unnecessary and grandiose projects to make their schools appear more competitive. Some 211-Universities covet the chance to be included in the 985 Project, which provides more generous funding to a smaller, more elite group of universities. Similarly, three-year colleges strive to become four-year universities because such a “progress” is quantifiable, measurable, and thus rewarded by the government. To these ends, many universities merge together to improve their national rankings. Because ranking takes into consideration the number of academicians, amount of funding, and number of majors, merging universities automatically improves an institution’s competitive edge. Such improvement ameliorates the career outlook of university

officials, who therefore vehemently pursue amalgamation.⁵¹

As such, current standards of evaluating school administrators may incentivize them to please the government instead of addressing the true needs of students. Now that the CCP stresses cultivation of innovative talents, it is important to determine whether universities are actually implementing changes that benefit and empower students, or are merely putting up the facade of reform.

While a dull learning atmosphere, faculty indifference, or ineffectual institutional design might not determine Chinese college students’ receptiveness to innovation-driven policies, these factors may influence students’ capability or desire to acquire innovative thinking skills. Consequently, this research sets out to examine Chinese college students’ perspectives on innovative thinking as shaped by elements that the state has or has not invested in under existing policies. The findings then help identify the strengths and deficiencies of current policies intended to cultivate innovation.

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⁵¹ Chen, Da Xue You Jing Shen, 159.
III. Research Methods

Overview

The central impetus for this research is derived from Shen Xiaobai’s argument that "a nation’s economic growth has always been linked to how well the state mechanism and policies can generate incentives for moving its development toward objectives and how effectively people are engaged in achieving these objectives." For policies to achieve state goals, they need to align with students’ internal and external incentives to effectively mobilize the population to adopt desired behavior.

I used original surveys and interviews to gauge Chinese college students’ perceptions of innovative thinking. There were two participant targets: college students and lecturers. Any undergraduate students in Chinese universities who were enrolled at the time of the survey or graduated no earlier than May 2010 were eligible to participate. Since this research addressed college professors as a potential resource to students’ cultivation of innovative thinking, I also interviewed a few professors who were visiting scholars at Harvard and teach in Chinese universities. Findings from these interviews either verified students’ observations or provided alternative perspectives on the same problems. Given that college students are the primary focus of this research, interview questions for professors are not discussed in this chapter but included in the appendix.

Surveys and interviews were designed to complement each other. The questions were identical but the two research methods had different focuses.

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Hundreds of survey responses were collected for statistical analyses while interviews, which provided no guidance on answers, gathered more in-depth and hopefully authentic responses. The combination enabled me to trace causes for certain trends in survey response.

**Surveys**

Survey participants were recruited through two sources. The first source was my peer network, which included two types of people: previous middle-school classmates who currently study in Chinese universities, and friends in the United States who have extensive connections with Chinese college students. To avoid selection bias, my friends were asked not to participate in the study. Instead, I requested them to forward the questionnaire to eligible connections or introduce potential interviewees. The second source of participants was a Chinese social network website called *Renren*, which contains similar features and functions as those of Facebook. In the summer of 2011, I sent individualized requests to all eligible *Renren* friends, which comprised approximately 80 percent of my *Renren* connections. They were asked to either complete a short questionnaire or share the survey with their peer networks; many of them kindly did both. While apparently not randomized, this snowballing survey and interview method has minimal impact on the representativeness of the participant pool for two reasons. First, most of these connections are established out of courtesy to others’ requests. In other words, I do not know many *Renren* friends on a first-person basis and have never met them in the real world. Given that the individuals who send me friend
requests can be arbitrary, the characteristics they share beyond age, gender and the fact that they attend Chinese universities are also random. What further supports the randomized nature of recruitment through Renren is that my connections attend a diverse range of colleges. As subsequent survey summary will demonstrate, student participants represent over 150 universities in China, which strengthens the diversity of the participant pool.

**Survey Design**

There were fifteen survey questions. All questions provided multiple options (usually four or five answer choices, including “other” for personalized responses). Question types entailed both single-selection and multiple-selection answers, and survey respondents were allowed to skip any questions they preferred not to answer. As mentioned, interview questions were the same as survey questions but provided no guidance on how to answer them in order to encourage free expressions of thoughts. I independently designed all of the questions and refined their Chinese translation with the help of Zhou Meng, a friend with a higher level of Chinese proficiency than mine.

The survey also gathered basic information such as school, year, and major of a survey participant. Since the survey was distributed in the summer, I asked for the class year students just completed to avoid confusion. Due to time constraints, only the school information was coded for regression analyses. Two other questions asked for the birth place and the hukou location of the student. Hukou is a common name used in mainland China for the household registration
system that officially identifies a person as a resident of an area. These questions intended to evaluate whether growing up in different regions with different social or economic exposure might influence students’ thinking habits, and for those whose hukou locations differ from their birth places, I speculated that they migrated to their current hukou locations and grew up there, which would lead me to use the hukou instead of the birth place information. Subsequent data, however, revealed that the hukou of students studying outside of their hometown often migrate with them to the cities where they attend college until graduation. As a result, hukou locations do not always correspond to the places where students grow up. In addition, these two questions also received a low number of responses, probably because they pertained to relatively sensitive information. Upon further reflection, I decided that studying the potential relationship between thinking habits and geographical regions is neither essential to the overarching research question nor sufficiently supported by collected data. Therefore, these two pieces of data were not analyzed. That said, environmental factors may constitute an important influence on students’ thought orientation. While this research could not study the impact of geography or socio-economic backgrounds of students, it did investigate in other environmental factors such as family influence, which are discussed in more details in the hypothesis section.

**Interviews**

This research also involved in-depth interviews with Chinese college students who did not participate in the survey. Student interviewees were
introduced by friends in my network and located in Beijing, Shanghai, Guangzhou, Hong Kong, and Shenzhen. The first three cities were chosen for the massive number of universities—particularly 985- and 211-Universities—in their areas, which added convenience to the interview process. The remaining two cities were chosen for two reasons. First, they are close to my residence in China. More importantly, these two cities are host to unique universities or university systems. Hong Kong universities, for one, are different from mainland universities in terms of administration, infrastructural support, and learning atmosphere because of both the ethnic diversity of students and the overarching democratic environment of Hong Kong society. Therefore, comparing responses from Hong Kong and mainland universities can enrich our understanding of the essential factors that influence college students’ adoption of innovative thinking.

Shenzhen was also chosen for its unique universities. Although there are only two universities in the city, one of them—South University of Science and Technology (SUST)—was built in 2010 with the ambition of pioneering higher education reform in China. Advocating de-bureaucratization and academic freedom, SUST burdens itself with the task of experimenting with different means of cultivating innovative talents. SUST’s progress, including both its successes and failures to date, can be immensely informative about the relationship between the government and universities that is conducive to cultivating innovative thinking.

53 http://www.sustc.edu.cn/about1.asp
To gather a diverse range of perspectives, I targeted at least four universities of varying prestige in cities with university towns (*daxue cheng*). Since I did not visit Beijing and focused on interviewee recruitment in Shanghai, interviews with students in these two areas were conducted subsequently by phone. I spoke with interviewees in person in all other cities. For cities where I did not recruit students myself, my friends helped select interviewees based on my criteria. Given the goal of speaking with four students from each school, I strove to be inclusive of gender, years, and concentrations. Among the 51 student responses, the gender ratio was approximately 1:1, all four class years were represented, and interviewees’ concentrations ranged from social studies and humanities to sciences and engineering.
Clearly, such a selection process was not randomized. Willingness to participate in a detailed conversation may depend heavily on a student’s interest in the research topic. This implies that interviewees might share a strong interest in either discussing or cultivating innovative thinking, and their responses might not be representative of most Chinese college students’ perceptions. This is not problematic, however. As stated, the purpose of interviews is to supply a context for understanding statistical findings associated with survey responses. They do not serve as a conclusive source of information. In this research, the range of interview responses did not differ substantially from that of survey responses for each question, and the former often helped explain the underlying reasons for certain trends in students’ answers.

To protect the privacy of study participants, no identity information was collected except for statistically useful traits such as class year, major, and university. In addition, a dozen of students chose the “other” option for some of the questions and provided detailed, thoughtful qualitative responses. Instead of including these responses in statistical analyses, I incorporated them into the qualitative analysis section.

Research Question and Hypotheses

My overarching research question addresses the impact of existing higher education policies on Chinese college students’ receptiveness to innovative thinking. Given that college students might not identify university resources as a result of policy implementation, direct inquiries of their attitudes toward policy
initiatives probably would not yield useful, concrete responses. Instead, I asked for students’ experiences with the different factors that may impact their capability or motivation to cultivate innovative thinking. In other words, this research gauged the effectiveness of university initiatives in the context of the relative impact of all possible motivators of innovative thinking, which then allowed me to infer the strengths and deficiencies of current policies in addressing these factors. Three such motivators were identified: universities’ capacity and resources, relevance of innovative thinking to personal goals, and intrinsic desire for critical thinking.

**Hypothesis One:** Students’ capacity for innovative thinking positively correlates with the accessibility of appropriate resources in universities.

*Independent Variable: Kinds of Available University Resources*

*Dependent Variable: Convenience and Capability to Develop Innovative Thinking*

The capacity of Chinese universities directly impacts students’ willingness and ability to develop innovative thinking. The availability of helpful resources lowers the barrier of their utilization and thus may prompt students to develop innovative thinking. On the other hand, these resources provide students with the tools to practice innovative thinking, thus enhancing students’ innovative thinking abilities. As mentioned in literature review, the MOE instructed universities to improve various resources that may facilitate innovative thinking, including curriculum design, training for college teachers, research centers, and range of majors. Besides explicit resources, universities also possess other assets that might help with cultivating innovation. Internships, independent projects, and
discussion atmosphere are among the possibilities. Four survey questions serve as key independent variables for this hypothesis: Question 6 tests professors’ impact, Questions 7 & 8 gauge students’ general perceptions of university support, and Question 9 examines the potential influence of plagiarism.

Figure 2. Key Independent Variables for Testing Impact of University Resources

| Question 6 | [Question 6] To what extent do most of your professors encourage students to raise thoughts different from theirs? |
| Question 7 | [Question 7] Which of the resources below do you think can effectively help you cultivate innovative thinking (select all that apply)? |
| Question 8 | [Question 8] Which of the resources below do you think are sufficiently present at your school (select all that apply)? |
| Question 9 | [Question 9] Do you think plagiarism is a prevalent phenomenon at your school? |

Question 6 does not directly capture the capabilities of faculty to imbue students with innovative thinking. Rather, its design is based on the consideration of what is necessary to foster critical thinking, which this research defines as a building block for innovative thinking. Since critical thinking encourages non-standardized—albeit evidence-based—solutions, tolerance of differences in opinions is critical to the development of such thinking habits. As a result, professors’ encouragement of diverse ideas in the classroom may lead to students’ adopting a more tolerant, open-minded attitude toward different opinions.

Questions 7 & 8 fulfill two purposes. First, they verify findings from the literature review. Accordingly, 985- and 211-Universities receive significantly more funding from the central and local governments than less renowned universities toward breeding innovation. Assuming that at least some of the funding is converted into relevant resources, we should find that students in the
former group of universities have access to more resources than those in the latter
group and therefore check off more boxes for Question 8. More importantly,
choices for these two questions are identical. A comparison of the responses can
therefore present a clear picture of whether universities are investing in what
students perceive as the right resources for cultivating innovative thinking. This
comparison, in turn, directly tests the first hypothesis.

The original intention of Question 9 was to gauge the survey participant’s
inclination to plagiarize. Upon reflection, however, I realized that few students
would report that they had committed plagiarism even if it were true. As a result,
the new focus of the question is on the overall learning atmosphere, and diction is
meant to portray plagiarism as a detached phenomenon to elicit honest responses.
The evident shortcoming of this approach, however, is that we cannot accurately
gauge individual students’ inclination to plagiarize; judgments of the prevalence
of plagiarism do not necessarily reveal students’ personal attitudes. Nonetheless,
this question allows us to test whether perceptions of the learning atmosphere
indirectly influence students’ motivation to develop innovative thinking skills. A
significant correlation, in turn, would signal that the broad learning environment
can be a vital aspect of universities’ influence on students.

**Hypothesis Two: Students’ incentive to cultivate innovative thinking
positively correlates with the importance of this skill to achieving students’
future goals.**

*Independent Variable: Students’ Future Goals, Particularly Career Orientation

*Dependent Variable: Desire to Cultivate Innovative Thinking*
The second stimulant to students’ development of innovative thinking is its alignment to students’ current and future goals. In other words, students develop an inclination to adopt innovative thinking when it is an effective means of meeting individual needs. One such goal is career development. After all, college education plays an important role in students’ future planning, be it job-finding or attending graduate schools. As a result, college students are incentivized to pursue innovative thinking if they perceive that employers or admissions officers value such skills. Nonetheless, students may likely lack incentives to practice innovative thinking in academics or extracurricular activities when one of the following occurs. First, innovative thinking skills are not on the list of key competencies desired by recruiters; alternatively, innovative thinking skills are valued, but their absence can be compensated with other attributes. One such attribute is relations (*Guanxi*). *Guanxi* is widely conceived as a long-established, hallmark characteristic of Chinese society. The term generally has two interpretations. First, it refers to strong or blood relationships with powerful figures. Few people possess such *Guanxi* due to its random nature. Alternatively, *Guanxi* can refer to networking-based relationships. More specifically termed as *Renji Guanxi*, such relationships can be cultivated and may help students access more opportunities. Either way, *Guanxi* might be robust enough to outweigh innovative capabilities in determining a student’s job placement. It is therefore important to find out what qualities college students believe can give them an advantage in job search and career development. If innovative thinking skills are not on their lists or
undermined by other credentials, they may have little incentive to pursue such skills regardless of university support.

Questions 13 and 15 are key independent variables for this hypothesis. Respectively, they ask for students’ post-graduation plans and ranking of elements that may influence their future advancement.

Figure 3. Key Independent Variables for Testing Impact of Future Orientation

<table>
<thead>
<tr>
<th>Question 13</th>
<th>What is your post-graduation plan?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Question 15</td>
<td>Based on your answers to the previous two questions, what characteristics or credentials do you think corresponding institutions value in applicants (please rank the following factors, with 1 indicating the most important criterion)?</td>
</tr>
</tbody>
</table>

Two types of responses are expected for Question 13: work and not work. According to the choices, those who choose not to work will either form start-ups or attend graduate school. The first option, entrepreneurship, entails innovative thinking but is not limited to it. It involves not only the generation of new or refined ideas but also the execution of ideas for economic gains. Therefore, I expect entrepreneurial students to show a stronger inclination to develop innovative thinking. Responses for Question 15, on the other hand, reveal whether college students perceive innovative thinking as a skill valued by desired employers and how perceptions affect adoption of innovative thinking.

A brief review of student responses for Question 15 shows two trends. First, many students did not complete the question as requested. Instead of ranking all variables, they only put a −4” next to the ability they perceived as most important to their future development. Furthermore, some students ranked multiple variables as −4,” which hints that they were unable to decide which of
these variables were more important and that they assign comparable weight to these variables. As a result, any responses that give “astute thinking abilities” a ranking of “1” are recorded as a vote for innovative thinking in subsequent statistical analyses.

**Hypothesis Three:** Students’ propensity to practice innovative thinking positively correlates with their exposure to this thinking mode in their earlier life stages.

*Independent Variable: Institutional and Non-institutional Influences in Earlier Life*

*Dependent Variable: Propensity to Adopt Innovative Thinking Habits*

The third source of motivation lies in the policy’s alignment with students’ internal incentives, which refer to students’ natural propensity to explore multiple and uncommon solutions. While the government has been investing heavily in universities, it seems to neglect the development of such innovative potentials in K-12 education. Such prioritization of university-level investment has several implications. First, the government might believe that investment in higher education for innovation yields better results than investing in K-12 education or spreading the resources across both. This speculation is reasonable given that the government’s end goal is to utilize students’ established innovative capabilities to generate innovative products, which K-12 students will not generally produce until they are older. Second, it alludes to the belief that providing sufficient resources at the college level can offset potential negative impact of pre-college experience on students’ creativity and motivation to practice innovative thinking. In other words, resources in universities can overcome the absence of creative-
thinking habits, which are commonly suppressed during exam-oriented K-12 education. This speculation would hold firm if the emergence of external stimulants such as university resources and career goals can more than compensate for a lack of internal incentives to think critically.

Pre-college exposure is often not unilateral, however. It involves not only institutional influences but also personal factors such as family influences and unique encounters. Therefore, weighing institutional factors against non-institutional in the pre-college period can help us understand whether individual attempts can successfully help students escape rote learning patterns, an integral part of the Chinese education system that may obstruct the development of innovative thinking.

Questions 2 through 4 gauge the impact of pre-college experiences. While Question 2 intends to focus on institutional impact, Questions 3 and 4 explore the potential influence of non-institutional factors on students’ thinking habits.

Figure 4. Key Independent Variables for Testing Impact of Pre-College Exposure

| Question 2 | Do you think the education you received before entering college has had any impact on your creative thinking abilities? |
| Question 3 | What kinds of people have had the largest impact on your thinking habits? |
| Question 4 | Based on your response to Question 3, to what extent do these people embrace and encourage your act of raising thoughts different from theirs? |

It is worth noting that the wording in Question 2 does not explicitly refer to schooling. Some students might interpret pre-college education as the overall educational experience before college enrollment and take into account non-institutional, personalized experiences. As a result, Question 2 might receive a
relatively diverse range of responses, and a correlation between Questions 2 and dependent variables might not be as strong as anticipated.

Question 3 explores whether students are more heavily influenced by teachers, people that are a part of formal educational institutions, or individuals outside of the education system. Question 4 then measures the degree of tolerance these people exhibit to students' expressions of individuality or independence. The assumption is that the attitudes of those whom students view as intellectually influential can largely shape their attitudes toward different opinions. Together, these two questions help contextualize responses to Question 2, the diction of which is indiscreet, and illustrate the key sources of influence on students' K-12 educational experiences.

**Dependent Variables**

As defined in the previous chapter, innovative thinking encompasses several elements: propensity to think critically, ability to conduct critical analyses, and creation of new ideas. The third aspect of innovative thinking is not measured in this research due to the limited scope of this study. None of the motivators examined here guarantees the generation of new, useful ideas. Whether innovative thinking skills result in scientific breakthroughs depends on too many other factors. Since this research defines policy effectiveness in terms of growth of any magnitude in innovative potentials, dependent variables record changes in one or more of the components of innovative thinking.

There are three dependent variables: Question 5, Question 12, and an
interaction variable based on Questions 7 and 8.

Figure 5. List of Dependent Variables

| [Question 5] In class or post-class discussions, your general attitude toward those who have completely different perspectives can be best described as: |
| [Question 12] In what areas do you think you have made significant improvement during college? (select all that apply) |
| [Interaction between Questions 7 & 8] Inferred Capacity for Innovative Thinking |

By asking for attitudes toward differences, Question 5 indirectly gauges students’ propensity to cultivate critical thinking and thus innovative thinking. The underlying assumption is that broad-mindedness is an essential element of critical thinking, which refers to objective evaluations of different, sometimes opposing, stances. Therefore, those who are more tolerant of disagreements may be better equipped to adopt innovative thinking habits. On the other hand, Question 12 does not ask directly about innovative thinking. It asks students to identify areas of improvement during college and provides “thinking and analytical abilities” as one of the choices. Question 12 is the only dependent variable that measures changes in students’ innovative thinking capabilities. As a result, it can effectively assess the potential impact of recent or imminent events such as university resources and career considerations.

The interaction variable between Questions 7 & 8 serves as the third dependent variable. If students think a resource is important to the development of innovative thinking and find that resource available at their schools, the convenience and accessibility of those resources may encourage students to utilize them to attain innovative thinking skills. As a result, each choice, which is
identical for both questions, is coded as an independent variable and receives a “1” if selected for either question or a “0” otherwise. I then multiply the two numbers for each choice, and only resources that were selected for both questions receive a “1.” Next, I sum up the products of each pair of independent variables to create a new, interaction variable to provide a scale for innovative thinking capacity. The resulting dependent variable is labeled “Inferred Innovative Thinking Capacity” throughout the research.

Overall Proposal

Summarizing the three hypotheses, I expect the following to happen:

Figure 6. Summary of Hypotheses

By providing appropriate and easily accessible resources, universities should both enable and incentivize the development of innovative thinking. In contrast, future utility of such skills and K-12 exposures are expected to shape only students’ propensity to practice innovative thinking.
If the above hypotheses are borne out by the data, I can reach the following conclusion:

While the development of innovative thinking entails both inclination and capabilities, the effectiveness of current higher education policies is determined not only by its independent capacity to cultivate both elements of innovative thinking but also by the relative impact of college students’ career incentives and degree of earlier exposure to creative thinking.

Out of the three sources of motivation, school capacity most closely relates to government investment in higher education; innovation-driven policies do not tackle students’ career goals and internal incentives. All three factors, however, are speculated to exert an influence on the development of innovative thinking. Therefore, analysis of perceived impact of higher education policies is founded on a comparison of the magnitudes and directions of the other two factors’ impact. For policies to be effective in cultivating innovative talents, I hypothesize that university resources need to be well executed to fill voids not addressed by the other factors—namely, to overcome any potential negative impact on innovative thinking from non-innovative K-12 education.

Data Analysis Procedures

I undertook three steps for quantitative data analyses. First, responses for each question were recorded into a Microsoft Excel sheet as written on the surveys. Then I ran pivot tables to look for basic trends. After basic operations in Excel, I coded responses based on methods that are detailed in the appendix and
ran statistical analyses using PASW Statistics 18, an SPSS software. Simple bivariate correlations were used to test hypothesized correlations. If correlations turned out to be significant, I ran regression tests for the same variables, occasionally controlling for certain factors when it is evident that they might influence the relationships being tested.

Lastly, correlations are not causations. I am aware that none of the analyses can prove the impact of current higher education policies. After all, the quantitative analyses conducted in this research are not sufficient to yield insights into the nature of relationships between variables besides their strength. Nevertheless, I strive to contribute to scholarly work on Chinese higher education by analyzing students’ responses to policy implementations. I hope my findings serve as a rudimentary reference for future inquiries into any of the categories examined at a macroscopic level in this research.
IV. Data Analysis

Basic Statistics

A total of 462 student survey responses were collected. Among them, 5 responses were either duplicates or empty. As a result, a total of 457 responses were recorded for statistical analyses. A considerable portion of responses either left one question or two blank or provided more answers than requested for specific questions. Instead of immediately eliminating such responses, I examined whether they could be salvaged based on specific coding rules. For example, Question 11 asked for students' fundamental reason for choosing their majors. The coding rules for this question bundled choices B, C, D, and E into one independent variable labeled as “1.” Therefore, an answer that selected both B and C is consistent with the coding rules and thus retained. An answer that selected both A and B, in contrast, is self-contradictory and thus removed. A complete list of coding methods is provided in the appendix section.

Out of 462 responses, 441 supplied basic demographic information. These responses showed that students from at least 170 universities participated in the survey. At the time of the survey, 148 participants were enrolled in 985-Universities; the remaining 293 students were enrolled in non-985-universities, yielding a ratio of 1:2. Relaxing the constraints to enrollment in 211-Universities—which include but are not limited to 985-Universities—yielded 231 students enrolled in 211-Universities and 210 enrolled in non-211-Universities, a ratio of 1.1:1. Given that the 211 and 985 Projects invest in only a small number

54 See Appendix D for a comprehensive list of schools. Affiliate schools or divisions are excluded from the total count.
of elite universities, either ratio is too high and indicates that the pool of survey participants is biased toward higher-ranking universities. Given my reliance on personal network for survey outreach, a certain degree of misrepresentation of the entire Chinese college student population is expected. To better gauge the breadth of challenges universities face in cultivating innovative talents, future research should broaden the reach to more remote regions. Nevertheless, problems found in this research are likely to occur at other unrepresented universities. If universities with sufficient funding face challenges in promoting innovative thinking, universities with less funding may likely face similar challenges to a more severe degree. As a result, the primary focus of this research is to uncover major issues surrounding innovation cultivation rather than discussing their pervasiveness.

While all questions are eligible for statistical analyses, some of them are only intended to provide qualitative context for understanding other relationships. Similarly, only statistical figures that directly contribute to discussions are presented in this section. A complete list of survey questions, including those not discussed in this chapter, is provided in the appendix.
<table>
<thead>
<tr>
<th>Name of Variable</th>
<th>Corresponding Survey Question</th>
</tr>
</thead>
<tbody>
<tr>
<td>211 status</td>
<td>Basic Information: University</td>
</tr>
<tr>
<td>K-12’s Influence</td>
<td>Q2. Do you think the education you received before entering college has had any impact on your creative thinking abilities?</td>
</tr>
<tr>
<td>Most Impactful People</td>
<td>Q3. What kinds of people have had the largest impact on your thinking habits?</td>
</tr>
<tr>
<td>Impactful People’s Tolerance</td>
<td>Q4. Based on your response to Question 3, to what extent do these people embrace and encourage your act of raising thoughts different from theirs?</td>
</tr>
<tr>
<td>Students’ Tolerance</td>
<td>Q5. In class or post-class discussions, your general attitude toward those who hold completely different perspectives can be best described as:</td>
</tr>
<tr>
<td>Professors’ Tolerance</td>
<td>Q6. To what extent do most of your professors embrace and encourage students’ act of raising thoughts different from theirs?</td>
</tr>
<tr>
<td>Inferred Innovative Thinking Capacity</td>
<td>Interaction Variable between Questions 7 and 8, where students identified resources that are helpful and accessible, respectively.</td>
</tr>
<tr>
<td>Prevalence of Plagiarism</td>
<td>Q9. Do you think plagiarism is a prevalent phenomenon at your school?</td>
</tr>
<tr>
<td>Improvement During College</td>
<td>Q12. In what areas do you think you have made significant improvement during college?</td>
</tr>
<tr>
<td>Post-Graduation Plan</td>
<td>Q13. What is your post-graduation plan?</td>
</tr>
<tr>
<td>Valuable Qualities for Future Development</td>
<td>Q15. What characteristics or credentials do you think corresponding institutions value in applicants?</td>
</tr>
</tbody>
</table>
Findings by Hypotheses

Hypothesis One: Impact of University Resources

Since the 985 and 211 Projects are a direct result of education policies, comparing students’ innovative potentials across the different types of schools can give us a quick overview of policies’ impact.

Figure 7. Comparison Between 985- and Non-985-Universities

Two points about the chart are worth noting. First, the y-axis represents the numerical scales that represent survey responses in statistical analyses. Since the three dependent variables are measured on different scales, cross-category comparisons carry no meaning. More importantly, this chart implies that students in 985-Universities do not necessarily exhibit higher innovative potentials than those in other universities. In fact, the latter does better than the former in tolerance of differences and innovative thinking capacity. While seemingly hard to comprehend, this phenomenon may be explained by the fact that non-985-
Universities include 211-Universities, a broader group of well-invested universities. Indeed, a comparison of 211- and non-211-Universities is consistent with my expectation that students in more resourceful schools possess greater potentials to develop innovative thinking skills:

Figure 8. Comparison Between 211- and Non-211-Universities

Analyses onward use the second comparison for two reasons. First, investment differences between 985- and 211-Universities can be considered negligible compared to differences between 211- and non-211-Universities. More importantly, this research examines the general impact of university resources. Since 211- universities are the more inclusive group of well-endowed universities, comparing them with the other universities can fulfill the objective of this research.

The charts above only disclose general trends. To gauge the differing impacts of 211 status on the three dependent variables, I ran statistical tests. The results show that the 211 status is significantly correlated with inferred innovative
thinking capacity (p=0.004). This is consistent with the hypothesis that more abundant university resources enhance students’ capacity for developing innovative thinking. Abundance in university resources also corresponded to higher degrees of tolerance of differences (p=0.045). The differences in p-values signal that while university investment enhances students’ capacity for development, it might have a smaller impact on attitudes toward differences.

Surprisingly, 211 status is not significantly correlated with improvement during college (p=0.118). If students are equipped with a higher capacity for cultivating innovative thinking but do not necessarily exhibit a stronger improvement in thinking abilities over others, they might have not utilized the resources effectively or at all. Before drawing this conclusion, we need to examine sources of error that may contribute to a weak correlation between 211 status and improvement during college. One source of error is self-identification bias. Regardless of reality, survey respondents may report the higher end of the scale as a result of positive self-perception. Perhaps such bias applies specifically to the question on improvement during college but not to the degree of tolerance. As a result, students tend to recognize their improvement on thinking abilities regardless of the universities they attend, but stay relatively objective in evaluating their tolerance of differences. That would explain why the 211 status is significantly correlated with the latter but not the former. Another feasible explanation is that the wording of the phrase is open to interpretation. That is, a progress in general thinking abilities is much easier to achieve than that in innovative thinking skills. As a result, more students selected –thinking and
analytical abilities” than they otherwise would. While these are hypothetical explanations, they remind us that statistical findings sometimes reflect errors in survey design or implementation rather than the strengths of hypotheses. Therefore, interpretations of correlations involving improvement during college take into account the potential effects of wording.

Diving into students’ perceptions of specific universities resources, the three resources deemed helpful by the largest number of students are internships, free discussion atmosphere, and independent projects.

Figure 9. Students’ Perceptions of University Resources

Two characteristics unify the three most popular resources. First, they correspond to independent endeavors. Students seem to place a stronger belief in the power of unguided explorations than in faculty influence. Second, they are intangible. Unlike research facilities and teaching quality, these resources address space rather than tools for development. Placed in the context that many students have been
burdened with an excessive academic workload, a stronger desire for opportunities over guidance is understandable.

Two other insights can be extracted from the chart. First, research facilities are the only resource where more students find them accessible than helpful. This observation does not, however, imply that further investment in research facilities is a bad choice. The green bars, which represent the number of students who find resources both helpful and accessible, are quite low. One explanation is that students who find research facilities helpful cannot access them, and vice versa. While not supporting the claim of reducing investment in research tools, the data suggests that funding alone does not strengthen universities’ capability of cultivating innovative thinking; rather, it is the allocation of funding that matters. In other words, money can play a useful role only if it is spent on resources that students find most helpful. This analysis, in turn, reinforces the underlying assumption of this research: policies must align with bottom-up incentives to be effective.

To gauge the impact of professors’ tolerance of different opinions, it is correlated separately with the three dependent variables. The only test that yields a low p-value is the one with inferred innovative thinking capacity (p=0.001). There are several explanations for this finding. First, professors at well-endowed universities consistently exhibit a higher degree of encouragement of students’ individualistic expressions. This would be the case if professors’ attitudes were also significantly correlated with the 211 status, which exemplifies heavily-invested universities. The follow-up correlation has a p-value of 0.435, so this
speculation is probably false. Another explanation is that students who tend to view their universities positively in terms of supportiveness may subconsciously romanticize their evaluations of their professors. In other words, students who feel positively about their universities tend to appreciate their professors as well. As such, professors’ leniency toward disagreements can be considered an integral part of university resources that help cultivate innovative thinking.

The relatively insignificant correlation between professors’ attitudes and students’ attitudes (p=0.074) implies that the former may not exert a substantial influence on the latter. Since we hypothesized earlier that inclination to develop innovative thinking is also associated with pre-college exposure, it is helpful to compare the relative impacts of the attitudes of people who emerge in different life stages.

The last key independent variable for the first hypothesis is the prevalence of plagiarism. Over half of the respondents believe that a moderate portion of students plagiarize at their schools. When asked about the most fundamental reason for plagiarism in Question 10, approximately half of the respondents attribute plagiarism to a desire to pass courses:
Some students indicated in supplementary notes that some of the choices provided for this question were interconnected. Indeed, those who desire to pass courses resort to plagiarism often when they are reluctant to study, which in turn points to laziness as the implicit reason for plagiarism. As subsequent qualitative data will reveal, however, the desire to pass courses may encompass not only laziness but also indifference to grades. In other words, even students who care little about grades want to do well enough to pass, which is necessary for them to receive their college diploma. Laziness or indifference, in turn, can be detrimental to the development of innovative thinking. Although the variables in this research cannot gauge the relationship between a student’s cheating behavior and innovative thinking potentials, they can assess if a dishonest learning atmosphere negatively influences students’ inclination to cultivate innovative thinking.

To do so, I explored whether perceptions of plagiarism differ across 211- and non-211-Universities. A correlation between the 211 status and prevalence of plagiarism yielded a correlation coefficient of -0.207 and a p-value
of 0.000. This relationship could suggest that perceived plagiarism is significantly higher in non-211-Universities. Alternatively, it is possible that students in high-ranking universities perceive just as much plagiarism as students in other schools do, but refrain from reporting them. In other words, if there are more stigmas at top schools, then the reporting levels can be low regardless of the amount of plagiarism. In this case, the “fame effect” would obscure the relationship between plagiarism and students’ innovative potentials.

To verify the second scenario, I controlled for the 211 status to see if the prevalence of plagiarism would still reliably predict students’ capacity or inclination to develop innovative thinking. The findings are astoundingly uniform: perceived prevalence of plagiarism is significantly correlated with all three dependent variables even when controlled for the 211 status.

Table 2. Correlations with Prevalence of Plagiarism

<table>
<thead>
<tr>
<th>Dependent Variables</th>
<th>Independent Variable: Prevalence of Plagiarism</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Standardized Coefficients</td>
</tr>
<tr>
<td>Inferred Innovative Capacity</td>
<td>-0.152</td>
</tr>
<tr>
<td>Tolerance of Differences</td>
<td>-0.122</td>
</tr>
<tr>
<td>Improvement During College</td>
<td>-0.108</td>
</tr>
</tbody>
</table>

The findings imply that within each cohort of universities, a higher level of plagiarism is persistently associated with lower inclinations and capacity for innovative thinking. Therefore, we can conclude that the “fame effect” is minimal.

“Fame effect” is not an esoteric term. It is used merely to describe how students’ self-perceptions rooted in the reputation of a university may impact their self-reported behavior.
We can derive two additional insights from these statistical tests. First, it seems that plagiarism is most strongly correlated with inferred innovative capacity. That is, perceptions of the learning atmosphere either constitute or impact perceptions of a university. More importantly, we cannot ignore the relatively low regression coefficients for all three correlations. While the low p-values indicate that the direction of changes in plagiarism consistently predicts that in students’ innovative potentials, the magnitudes of changes in the two variables are not always proportional. This is not, however, problematic for two reasons. First, the coefficients depend largely on my coding methods. For example, some variables are coded on a scale of 1 to 5, whereas others are coded as binary variables (which receive a “1” if selected and a “0” otherwise). Given the large variations in coding methods, a comparison of coefficients for different variables offers little insights. More importantly, this research measures policy effectiveness in terms of positive changes toward the realization of innovative talents. As a result, the direction of changes matters much more than their magnitudes; p-values and the signs of correlation coefficients provide sufficient information to deduce the former.

In summary, the statistical findings are largely consistent with the first hypothesis. Financial investment in universities may help enhance college students’ capacity and propensity to nurture innovative thinking, but the use of the funding is equally important. In particular, students seem to value opportunities for independent explorations more than research tools and faculty guidance. Lastly, plagiarism may indirectly influence students’ perceptions of the strengths
of university resources and discourage the development of innovative capacity.

Hypothesis Two: Impact of Career Orientation

The key variables for the second hypothesis are post-graduation plans and valuable qualities for future development. Approximately 36 percent of the survey respondents chose work, 31 percent chose domestic graduate school, 27 percent chose overseas graduate school, and only about 6 percent planned to become entrepreneurs. In addition, participants had diverse views on which skills are most valuable for their career development:

Figure 11. Most Valuable Skills for College Students’ Future Development

Most of the survey respondents do not perceive personal networks as the most important trait for future development. This observation, in turn, nullifies the speculation that relationships are superior to other qualities and can compensate for their absence.

The first pair of tests gauges which career paths tend to have a high
demand for strong thinking abilities, a component of innovative thinking. Initially, I speculated that entrepreneurial students value critical thinking abilities significantly more than students with other career goals. Therefore, I coded “entrepreneurship” as 1 and all other choices as 0 for the career path variable. The resulting correlation between these two independent variables is not only insignificant but also negative (p=0.822). This is surprising since entrepreneurial students are not expected to value astute thinking abilities less than others. Before concluding that career orientation has arbitrary demands for innovative thinking, I recoded the career path variable by loosening the assumption that only entrepreneurship places a high demand on innovative thinking capabilities. Postulating that graduate schools generally have more rigorous requirements on students’ research abilities, I coded all choices except for “work” as 1’s and re-ran the correlation. The resulting p-value is 0.052, which is much smaller than before but still not significant at the 0.05 level. A third coding pattern in which only “entrepreneurship” and “overseas graduate school” are labeled as 1’s yielded a p-value of 0.006, which indicates a significant positive correlation. These findings lead to an interesting observation: students tend to think that innovative thinking abilities can give them a significant advantage in pursuing entrepreneurship or overseas studies. Such a perception can root in the types of degrees people seek when they study abroad; perhaps college students tend to pursue research-intensive programs abroad. If, however, overseas-inclined students pursue just as broad a range of degrees as their counterparts in China do, the strong association between overseas studies and perceived importance of
innovative thinking implies that Chinese college students may perceive overseas programs to be more rigorous in the demand and training of intellectual capacity than are domestic programs.

The second hypothesis states that career goals may influence students’ inclinations to develop innovative thinking. To test this, the two independent variables are correlated separately with the three dependent variables. The first independent variable, “career path,” significantly correlated with students’ attitudes toward differences (p=0.021) but not with inferred innovative capacity (p=0.487) or improvement during college (p=0.893). In contrast, the second independent variable, “valuable skills,” exhibited a significant correlation with improvement during college (p=0.008) but not with inferred innovative capacity (p=0.409) and attitudes toward differences (p=0.202). In other words, the only commonality of these two independent variables was that neither reliably predicted students’ perceptions of university resources, which is reasonable. Beyond that, the two variables present contradictory information, making it difficult to evaluate the hypothesis. Could a lurking variable mask the true relationship between career orientation and college students’ inclination to develop innovative thinking?

Based on current results, students who are entrepreneurial or overseas-inclined tend to possess a higher degree of tolerance of different ideas. Recalling that tolerance is also significantly correlated with the 211 status, I controlled for 211 status and re-correlated the career paths variable with tolerance. This time, the correlation is much weaker (p=0.056). To further verify the lurking impact of 211
status, I correlated it with the career paths variable. As expected, the two are significantly correlated ($p=0.001$). In other words, career orientation does not necessarily lead to a higher propensity to adopt innovative thinking habits. In fact, both can be a result of attending a 211-University. That is, attending 211-Universities may boost students’ confidence in successfully launching certain careers while encouraging a higher degree of tolerance of differences. Alternatively, exposure to the resources abundant at 211-Universities—particularly exchange programs—introduces students to the concept of studying abroad. It is premature, however, to reject the second hypothesis at this point. Given that the p-value of the correlation between career paths and tolerance of differences is near the 0.05 level even when controlled for the 211 status, we need to better understand the overall picture before drawing a conclusion.

Figure 12. Correlation Results Surrounding the Second Hypothesis

**Independent Variables**

- Career Paths
- Desired Skills for Future

**Dependent Variables**

- Tolerance of Differences
- Improvement in College

---

Significant Correlation ($p \leq 0.05$)

Insignificant Correlation ($p > 0.05$)
Statistically, this phenomenon is comprehensible. By definition, p-value describes the likelihood that the observed results can be ascribed to chance alone. The lower the value, the less likely that chance is the only factor driving the relationship between two variables. Therefore, a low p-value speaks to the existence of a relationship. It does not, however, describe the strength of the relationship. To gauge strength, $R^2$ should be used. $R^2$ tells us the amount of variance in the dependent variable that can be explained by the independent variable. While p-value and $R^2$ move in the same direction, a low p-value does not presuppose a high $R^2$ value. The $R^2$ values of the correlations above are smaller than 0.02. As a result, it is not surprising that two independent variables are significantly correlated with one another but exhibit different strengths of relationships with the same dependent variable.

Qualitatively, there are several explanations for the digression. First, there can be priming effects. Perhaps valuable skills for the future do not correlate with improvements in thinking abilities at all. Students may rank “astute thinking abilities” as the most important skill simply because they see it as a natural progression from identifying “thinking and analytical abilities” as an area of improvement in Question 12. Another explanation is that different variables measure different aspects of innovative thinking. Improvement during college, for example, measures changes in thinking abilities. The tolerance variable, in contrast, gauges static attitudes toward different ideas. If external incentives indeed drive behavior that would not have formed otherwise, then identifying innovative thinking as a highly desirable skill would drive positive changes in
students’ thinking abilities, which in turn should be—and is indeed—reflected in a significant correlation between valued skills and improvement during college. On the other hand, a high regard for the value of innovative thinking does not presuppose a high level of propensity toward developing innovative thinking, so it would not nullify the hypothesis if the valued skills variable is not significantly correlated with tolerance.

Trends surrounding the career paths variable can be explained in a different direction. Career paths alone do not inform us of students’ perceptions of the value of innovative thinking. Therefore, a significant correlation between career paths and tolerance of differences is unlikely an indicator of future orientation’s impact on current behavior. Instead, it is more plausible to hypothesize that college students’ current attitudes toward diversity shape their career path selections. Regardless of what has influenced students’ tolerance of differences, the fact that some students enjoy heterogeneous discussions may lead them to realize that studying abroad or starting a new company fits their thinking and work styles more, which in turn prompts these students to select these career options. Once students identify the careers they plan to pursue, they proceed to brainstorm which skills are needed to achieve their goals, which helps explain the strong correlation between career paths and valuable skills. As a result, the relationship between the four variables can be rearranged as follows:
While this pattern matches all correlation test results listed previously, it is but one of the plausible explanations. In summary, considerations of the future may have an impact on students’ adoption of innovative thinking habits, yet we cannot be certain of the strength of the relationship.

Perhaps placing the analyses into context can provide better clarity on the impact of career orientation. Indeed, a comparison of the relative impacts of university resources and career goals shows that they are strongly associated with different aspects of innovative thinking.
Table 3. Comparison of Correlations with Tolerance

<table>
<thead>
<tr>
<th>Independent Variables</th>
<th>Dependent Variable: Tolerance of Differences</th>
<th>Standardized Coefficients</th>
<th>Significance</th>
</tr>
</thead>
<tbody>
<tr>
<td>211 status</td>
<td></td>
<td>0.097</td>
<td>0.042</td>
</tr>
<tr>
<td>Valuable Skills for the Future</td>
<td></td>
<td>0.062</td>
<td>0.197</td>
</tr>
</tbody>
</table>

Table 4. Comparison of Correlations with Improvement During College

<table>
<thead>
<tr>
<th>Independent Variables</th>
<th>Dependent Variable: Improvement During College</th>
<th>Standardized Coefficients</th>
<th>Significance</th>
</tr>
</thead>
<tbody>
<tr>
<td>211 status</td>
<td></td>
<td>0.077</td>
<td>0.103</td>
</tr>
<tr>
<td>Valuable Skills for the Future</td>
<td></td>
<td>0.127</td>
<td>0.008</td>
</tr>
</tbody>
</table>

On the one hand, university resources—which are largely determined by the investment status of a university—are a better predictor of students’ tolerance of differences than valuable skills are. On the other hand, career orientation may have a more decisive impact on students’ actual gains in innovative thinking abilities. Collectively, these findings suggest that students’ willingness to strengthen their skills for achieving career goals does not always translate into a growing fondness for the innovative thinking mode. In other words, strong external incentives might compensate for a lack of inherent interest in critical thinking in motivating an improvement in innovative thinking abilities. This observation is intriguing for two reasons. First, it shows that incentives do indeed matter. Students need some kinds of motivation to carry out a task. More importantly, we should not forget that improvement during college is significantly correlated with tolerance of differences. That means students who find astute
thinking abilities valuable tend to exhibit a relatively high degree of tolerance. Therefore, we cannot preclude the possibility that strong external incentives can eventually breed internal affinity for critical thinking.

The counterpoint is also worth noting. While university resources may significantly impact students’ capacity and inclination to develop innovative thinking, they exhibit a weaker potential impact on students’ improvement during college. This pattern has two implications. First, capacity does not necessarily equate to ability. Throughout this research, the “inferred capacity” variable refers to how equipped students are in developing innovative thinking rather than their actual behavior. This is because the construct of this variable equates capacity with the abundance of accessible and helpful resources; the variable says nothing about whether or how students utilize these resources. Based on this understanding, we can infer another point from the statistical results: university resources seem helpful, but insufficient, in cultivating innovative talents. Something can be missing if greater capacities are not converted into enhanced abilities. The missing elements cannot be discovered from statistical results and are instead explored in the final chapter.

**Hypothesis Three: Impact of Pre-College Exposure**

The third hypothesis states that pre-college exposure may influence college students’ inclination to develop innovative thinking. Two key variables test this hypothesis. The first variable, pre-college impact, gauges the nature of impact of pre-college education:
Contrary to the prediction that pre-college education would have a negative impact on creativity formation, the response that occurs most often is “somewhat positive.” As discussed in the method section, this phenomenon is expected because the vague phrase “pre-college education” may lead to a multitude of interpretations of the question. Therefore, the pre-college impact variable does not accurately reflect the potential impact of K-12 schooling. Indeed, a regression analysis between pre-college impact and tolerance of differences returns a p-value of 0.659, which confirms the unreliability of this independent variable. A correlation between pre-college impact and another independent variable provides new information, however. Specifically, pre-college impact is strongly correlated with Question 4 (p=0.000). Since Question 4 measures tolerance of the people who have had the most impact on students’ thinking styles, this robust relationship suggests the following: memorable individuals—school- or non-school-related—may largely shape students’ overall impression of their K-12 education.
experience. As a result, Question 4 is used as the central indicator of college students’ pre-college experience in subsequent statistical analyses.

Question 3 asks respondents to identify the type of people who have had the most impact on their thinking habits. The majority of participants selected parents, teachers, or friends; only one chose “colleagues.” This makes sense given that college students have relatively little work experience and are not likely to have many colleagues at this point.

Figure 15. People Who Have Had Most Impact on Students’ Thinking Habits

Three features are worth noting. First, the most frequent response is “parents.” Given the substantial length of time most children spend with their parents, there can be a correlation between time and the cultivation of innovative thinking habits. In this case, incremental yet sustainable influences might create a more profound change in thinking habits than intensive but short-lived influences such as university investment. Second, this chart explains the unexpected distribution of responses for the pre-college impact variable. That is, students might have incorporated non-institutional sources of influences—such as parents and
friends—into their evaluations of their overall pre-college experience.

More importantly, 24 students selected multiple answers, even though this question asked for only one. Their insistence to mark several answers indicates indecision between which choices have a greater impact on them, which in turn suggests that thinking habits can be shaped by multiples sources. The versatility of thinking modes in turn denotes that thinking can be remolded over time. No one source of influence stays permanently dominant, and changes in the environment can continuously modify one’s thoughts. As a result, deficiencies of positive influence in childhood might be compensated to a certain degree by motivators present in later stages of life. If this were true, university investment in innovative thinking can be helpful regardless of students’ previous exposure. That said, the magnitudes of impact of different factors vary. Influences that emerge in later stages of life might not be able to overcome or rival the impact of factors that are previously present. While this analysis is preliminary and largely ungrounded at this point, it serves as a useful reference for assessing the overall hypothesis—namely, the relative impacts of different independent variables.

A correlation between the attitudes of impactful people and students’ attitudes is highly significant (p=0.001). This means that the attitudes of those with a substantial impact on students reliably predict students’ attitudes toward diversity. A subsequent regression test compares the impact of these people with that of professors:
Table 5. Relative Impact of Different Peoples’ Attitudes on Students

<table>
<thead>
<tr>
<th>Independent Variables</th>
<th>Dependent Variable: Students’ Tolerance</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Standardized Coefficients</td>
</tr>
<tr>
<td>Impactful people</td>
<td>0.144</td>
</tr>
<tr>
<td>Professors</td>
<td>0.071</td>
</tr>
</tbody>
</table>

The results show that these profoundly influential people may have a greater impact on students’ open-mindedness than professors do—a crucial discovery. While it seems intuitive that professors would exert a direct and thus stronger impact on students, the insignificant correlation implies that students’ attitudes toward innovative thinking are formed prior to or regardless of faculty-student interactions. In other words, attitudes seem more resistant to change than capabilities are. They take longer to form, a property that likely favors people who have influenced students since their childhood over college professors.

Correlations between the attitudes of impactful people and the other dependent variables yield similarly significant results. More specifically, the p-value for the correlation with inferred innovative capacity is 0.000, and that with improvement during college is 0.010. While it is unlikely that the attitudes of these people directly shape students’ capabilities or motivation to develop innovative thinking, the fact that this variable is significantly correlated with all aspects of innovative thinking signals the depth of these people’s impact on students’ self-perception. In other words, students who have been encouraged to form independent thoughts might be more confident in their innovative potentials,
which further engages their interests in innovative thinking.

Since the overarching goal is to understand the relative impacts of different motivators, the next section synthesizes individual findings and conducts aggregate analyses.

**Overall Quantitative Evaluation**

Before we proceed, it is helpful to recapitulate the overall research direction. According to my hypotheses, universities should both enable and incentivize the development of innovative thinking by providing appropriate and easily accessible resources. On the other hand, the utility value of such skills and K-12 experiences are expected to shape college students’ attitudes toward innovative thinking without affecting their abilities.

This research originally attempted to measure only two aspects of innovative thinking: capability and propensity. As mentioned, this research gauges growth toward instead of achievement of innovative thinking. Since no thinking style can guarantee the production of new and useful ideas, I omitted the third defining aspect of innovative thinking—new idea creation—from this study. Nevertheless, my understanding of the dependent variables has evolved during the process of data analysis. That is, I became aware of the need to distinguish capacity from capability. As a result, I adjusted the framework to test three independent variables against three dependent variables.
Table 6. List of Variables Used for Aggregate Analyses

<table>
<thead>
<tr>
<th>Type of Variable</th>
<th>Category of Predictor</th>
<th>Variable Used</th>
</tr>
</thead>
<tbody>
<tr>
<td>Independent</td>
<td>University Resources</td>
<td>211 status</td>
</tr>
<tr>
<td>Independent</td>
<td>Career Orientation</td>
<td>Valuable Skills for the Future</td>
</tr>
<tr>
<td>Independent</td>
<td>Pre-College Exposure</td>
<td>Attitudes of Most Impactful People</td>
</tr>
<tr>
<td>Dependent</td>
<td>Propensity to Develop Innovative Thinking</td>
<td>Students’ Tolerance of Differences</td>
</tr>
<tr>
<td>Dependent</td>
<td>Capacity to Develop Innovative Thinking</td>
<td>Inferred Innovative Capacity</td>
</tr>
<tr>
<td>Dependent</td>
<td>Ability to Think Critically</td>
<td>Improvement During College</td>
</tr>
</tbody>
</table>

To conduct aggregate analyses, a multiple regression test is run for each dependent variable. Findings are summarized into the following table.

Table 7. Summary of Findings

<table>
<thead>
<tr>
<th></th>
<th>Propensity</th>
<th></th>
<th>Capacity</th>
<th></th>
<th>Ability</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>P-value</td>
<td>Rank of Importance</td>
<td>P-value</td>
<td>Rank of Importance</td>
<td>P-value</td>
<td>Rank of Importance</td>
</tr>
<tr>
<td>University Resources</td>
<td>0.031</td>
<td>2</td>
<td>0.003</td>
<td>1</td>
<td>0.112</td>
<td>3</td>
</tr>
<tr>
<td>Career Orientation</td>
<td>0.264</td>
<td>3</td>
<td>0.478</td>
<td>3</td>
<td>0.010</td>
<td>1</td>
</tr>
<tr>
<td>Pre-College Exposure</td>
<td>0.002</td>
<td>1</td>
<td>0.000</td>
<td>1</td>
<td>0.013</td>
<td>1</td>
</tr>
</tbody>
</table>

If the p-values for a dependent variable share the same number of zero digits after the decimal point, the corresponding predictors receive the same ranking of importance. Altogether, we can infer that university resources have the most decisive potential impact on students’ capacity for developing innovative thinking. It might similarly facilitate a stronger inclination to cultivate such skills,
but these two significant correlations do not necessarily result in enhanced thinking abilities. Career orientation seems to have an even weaker impact on innovative thinking overall. It has little impact on college students’ internal drive to think critically and does not affect students’ confidence in university supportiveness. Nonetheless, it seems capable of stimulating the practice and thus improvement of innovative thinking skills. In contrast, pre-college exposure is the only independent variable that is significantly correlated with all three aspects of innovative thinking at the p=0.05 level. Such strong correlations, however, do not necessarily imply causation. The encouragement of impactful people can reasonably shape the degree of tolerance of college students, but it is unlikely to impact their capacity for development as the latter depends largely on the helpfulness of resources in students’ immediate surroundings. Instead, the strong correlations surrounding pre-college exposure allude to two possible trends. First, attitudes can have a considerable impact on abilities. Passion for critical thinking can prompt actions in that direction that in turn result in strengthened innovative thinking skills. It is equally possible for attitudes to have little direct impact on thinking abilities. This leads into the second implication of these uniformly significant correlations: encouragement of individuality in childhood might substantially impact students’ self-perceptions. College students who were positively influenced in the past might not necessarily outperform others in terms of thinking abilities; they might, however, enjoy higher confidence in cultivating innovative thinking.
V. Discussion & Conclusion

Aggregate findings suggest that university investment has not fully realized its capability to influence college students’ thinking habits. Resources at 211-Universities are relatively abundant and helpful, but they might not be utilized often enough to generate growth in innovative potentials. Indeed, in-depth interviews with professors and students reinforce the statistical finding that unaddressed needs may impede the realization of innovative talents. These needs fall into two broad categories: university-related implementation and impact of the broader educational system. The first category, in turn, entails two aspects: inadequate attention to needful resources, and a lack of infrastructural accommodation, which refers to incongruous system design in universities that depresses the utilization rate of innovation-intended resources. Therefore, this section discusses interview results to refine our understanding of the roadblocks that may suppress policy effectiveness, integrates all analyses with additional literature review, and recommends next steps for raising policy effectiveness and areas for future research.

University-Related Implementation

Some student interviewees were doubtful of the helpfulness of current university resources. Their reasons can be grouped into two categories: insufficient investment in resources that they believe are important and a lack of infrastructural support. These viewpoints do not illustrate the prevalence of potential obstacles. After all, interview results are not meant to be representative
of the predominant views of the Chinese college student population. Instead, they fulfill two purposes: to contextualize statistical findings to identify the root causes of certain phenomena, and unveil exogenous factors that are not examined in this study but can serve as the basis for extensive research.

**Current Investment Situation**

A lack of an effective student-feedback system may contribute to investing in the wrong resources. A sophomore majoring in information technology at Fudan University, a 211- and 985-University, advocated for a better understanding of students’ perspectives:

The university should build platforms that students think are useful. Given that students are the ones who utilize the resources, the university should provide resources that students believe are important instead of imposing on students what the university thinks is important.

A junior at Sun-Yat-Sen University majoring in math and information technology echoed the theme of improper resources:

Exemplary courses (*jingpin kecheng*) at the school receive relatively little attention. Students don’t know much about them and don’t inquire about them as a result. My parents are college professors, and they told me that the creation of these courses was a top-down command, which universities have to meet. I think this is a reflection of the entrenchment of the government ideology.

We can infer two trends from these comments. First, top-down influence is decisive to the types and quantities of university investment. In the end, nurturing innovative talents is a state-initiated goal. Therefore, investment in new university resources is a means of meeting the government’s expectations. A desire to demonstrate their fulfillment of state’s goals subsequently motivates universities
to invest in visible and directly relevant resources. As mentioned in the literature review chapter, some 211-Universities spend a substantial amount of money on upgrading research facilities and purchasing new research equipment, items that can easily show appropriate use of government funding. Given that the state does not measure goal completion by the utilization rate of these resources, university leaders would have fulfilled their responsibilities by merely making sure the money is spent. Yet anxiety to demonstrate execution of the state’s goals is not equivalent to a desire to achieve them. In fact, the former sometimes compromises the latter. Negligence of the needs of beneficiaries, the college students themselves, often results in their inability to leverage university resources to uncover their innovative potentials, which in turn impedes the fulfillment of the state’s goals. As a result, incorporation of students’ feedback can add substantial momentum to realizing the Chinese government’s ambitions.

Other student interviewees pointed to several under-invested resources that can significantly enhance their cultivation of innovative thinking. A sophomore studying tourism management at South China Normal University spoke to the importance of libraries:

The libraries need to be updated in terms of diversity, quantity, and quality of collection. I browsed them and it seems that any outlandish or controversial books that I heard about from friends and on the internet cannot be found. If libraries are intended to be a place that broadens students’ scope of knowledge and liberates curiosity-driven souls, then it should accommodate as many students’ choices as possible by being tolerant and inclusive.

Similarly, a senior studying biology at China Agricultural University in Beijing voiced that current book collections are unwelcoming:
The libraries definitely need improvement. I don’t mean the exterior needs any more embellishment; I meant that the book collection can be broadened. Current books are dry and too specialized in a certain field; it is difficult to find inter-disciplinary books at our school. The main point is to turn libraries into a place that engages students in reading by providing interesting, impactful books and a comfortable reading environment.

The current situation of book collections in this university seems to reinforce the concept that inclination to learn directly impacts capacity for learning. Students might never realize that they have access to and can even expand their capacity for innovative thinking if nearby resources discourage such self-discoveries. While these comments point to existing shortcomings in university investment, they also raise hope. That is, universities may enhance students’ inclination and capacity to develop innovative thinking by investing in resources that are not directly relevant to innovation breakthroughs but crucial to the cultivation of innovative thinking habits.

Research and experimentation platforms are another useful resource. A student who graduated in May 2011 from South China University of Technology gave experimental center as an example:

Chinese students have creative ideas but lack the platform to experiment with them. I think for engineering students the best resource for cultivating innovation is a processing center where they can use toolkits to build models. In my view, we lack such centers because we are short of funds, by which I don't mean government funding. I mean self-sufficient funds….Giving funding to students does not guarantee results, so the money is better spent if allocated to professors instead.

Another engineering student at the same university recommended independent research programs:
Schools should develop student research programs where students initiate and implement their own ideas. Right now, the best research resources students can access are internships or assistant positions to professors who are conducting research.

Instead of receiving step-by-step guidance, college students seek the opportunity to experience trial and error themselves. If self-directed experiential learning is highly valuable to science and engineering students, investing in such opportunities can directly contribute to the formation of innovative talents in areas highly valued by the government.

Inadequate Infrastructural Support

Interviewees also expressed a need for better student-professor interactions. Unlike the previous category of resources, however, a lack of interactions with professors indicates inappropriate infrastructural accommodation. A senior majoring in marketing and advertisement in Shenzhen University hinted at the root of the problem:

The student-teacher relationship is not healthy; actually, there is no relationship at all. Students are not willing to proactively interact with professors, nor are faculty members eager to seek student feedback on their teaching. I think the problem lies in the system itself. Teachers are suppressed by the system: they have to complete banal, useless tasks, so even if they want to teach students real substance, they don't have the time or flexibility to.

The student who majors in tourism management reiterated the lack of professors’ feedback on students’ work:

There is very little interaction with teachers, and what's worse is that we receive no concrete feedback on group projects besides a letter grade. How can we improve critical thinking skills when we don't know on which aspects we need work?
Even though professors can and are desired by students to play a supportive role in stimulating critical thinking, their heavy workloads often prevent them from being able to provide such support. Interviews with a few professors from Chinese universities detailed some of the “banal tasks” mentioned by students and revealed pressure from multiple sides, including publishing demands and financial stress. As described by a sociology professor from a 985-University in Beijing:

Different ranks of professors face different kinds of pressure. Some younger teachers in non-popular fields don't have many opportunities and therefore need to rely on outside income sources (waikuai). The situation is better in 985-Universities since professors’ salaries are generally higher. Regardless, professors need to complete 216 hours of teaching and publish at least two articles annually in core research journals to receive subsidies.

As a result, the income level of faculty members indirectly determines their availability and helpfulness to students. Those with higher incomes, which tend to aggregate in universities with significant government funding, are less likely to need additional revenue sources and therefore may have more time to interact with students. Even then, however, the sheer number of students might make interactions difficult. As discussed in the literature review chapter, enrollment expansion in recent years has led to the construction of new campuses. Rather than hiring additional professors for these new campuses, existing professors are expected to teach across multiple sites, forcing them to rush back and forth between classes. A professor of Japanese studies in Chinese University of Hong Kong confirmed this general trend:
Hong Kong professors’ salaries are quite decent and most professors do not feel urged to seek income outside of university positions. That said, we are often overworked in the sense that there are too many students for us to interact with each of them closely or frequently.

As a result, raising faculty members’ income and recruiting new teachers can be conducive to the cultivation of innovative thinking. The former can lower college teachers’ incentives to seek part-time positions and accommodate a better focus on teaching, whereas the latter makes it possible for professors to interact more frequently with students. More opportunities for concrete and individualized feedback, in turn, enable students to seek answers to thoughtful questions, identify areas of academic improvement, and obtain suggestions to make those improvements, all of which can contribute to growth in innovative potentials.

Even if professors are willing and capable of providing guidance, academic pressures on students might prevent them from taking advantage of such opportunities. A junior who majors in applied chemistry at Shenzhen University and a sophomore who majors in smart building technologies at Tongji University both expressed the need for a reduced workload:

Given how many classes students have to take, we inevitably cannot spend too much time on any one course. Condensing all of the knowledge taught by professors is a challenging enough task, so critical thinking, which is built upon comprehension of facts, would be a luxury. In fact, a lot of my friends cannot manage their time in the face of enormous pressure, and (as a result) they plagiarize as a last resort to meet basic academic requirements.

These students’ comments illuminate an intricate relationship between critical thinking and plagiarism. In earlier statistical analyses, we learned that a corrupt learning atmosphere can indirectly impact students’ propensity to embrace
different opinions. We were not able to determine how likely an individual student might plagiarize and whether that tendency is correlated with the same student’s inclination to think critically. These interviews, however, suggest that such a connection may exist. In other words, a plagiarizing student might also possess little interest in critical thinking. Instead of having a causal relationship, these two traits tend to occur alongside each other because both stem from academic pressure. In other words, an unmanageable amount of work makes it difficult to keep up; therefore, developing critical thinking—a process which requires extra efforts—is not a priority. Difficulty of managing the current workload, in turn, drives some students to plagiarism. Consequently, reducing the number of courses students are required to complete, while enhancing the depth of discussions in each course, may not only strengthen students’ bandwidth for innovative thinking but also reduce the desire to plagiarize.

Other details in infrastructural support can also impact the effectiveness of policy implementation. For one, many universities—including high-ranking ones—lack capacity-building courses that teach college students research methods and writing techniques. The same student from Fudan University described his research writing experiences in college:

I first encountered research-paper writing in my college freshman year, and it took me a while to finally know how research papers are different from expository essays we wrote during high school and how to prepare them. Teachers, however, don't take adjustments into account; they expect you to write good research papers regardless of your previous exposure or readiness, so it's not hard to see why we [college freshman] need to rely on imitation to a certain extent at the beginning.
Without systematic training in conducting original research or appropriately using evidence for secondary research, Chinese college students might lack the ability to distinguish plagiarism from reference. Worse yet, they might develop the habit of relying disproportionately on others’ viewpoints in writing their research reports, thus impeding the cultivation of independent thinking. Similarly, not being provided with syllabi—which give students a macroscopic understanding of the objectives of a course and enable them to prepare for materials taught in upcoming lectures—aggravates students’ reliance on professors rather than themselves for learning. As a result, specifics such as basic methods courses and the availability of course syllabi can transform college students’ learning experience and make it more convenient for them to establish innovative thinking.

**Impact of Broader Educational System**

Strengthening infrastructural accommodation is helpful only to a certain extent. Strategies described above that optimize the utilization of university resources can benefit only self-motivated students. Those with a passive mentality are not likely to proactively seek professors’ feedback, peruse syllabi, or browse libraries even when these resources are abundant. Indeed, a sophomore at Tongji University expressed a pessimistic view on higher education reform:

Tongji’s problem lies not in a shortage of investment in resources. The fundamental problem is that few, if any, students are willing to learn. So many of my friends spend their days playing games, and I think it's because they view college life as a compensation for all the suffering they went through to get into college. To them, college implies an end to suffering—they are supposed to enjoy themselves as much as they can now. So it's not about having insufficient resources, it's that few students have motivation to
even utilize existing ones. I think the examination system is problematic, but part of its defects can be attributed to the vast population. There has to be some barriers to distinguish good and bad students, but constant eliminations and competitions have destroyed a huge chunk of individuality and inherent motivation.

Based on this student’s observation, the problem seems to lie in the overall education system instead of current university investment. These students implicitly argue that poor attitudes can compromise students’ innovative thinking potentials. They are not confident that investment in higher education can override the negative impact of K-12 education on students’ attitudes toward learning. For these students, an overhaul of the K-12 education is indispensable to the success of innovation-oriented policies.

Since inferences are drawn from correlations instead of causations, I cannot objectively evaluate the alleged decisive impact of K-12 influences. While statistical analyses show that attitudes of the people who have had a huge impact on students’ thinking styles are considerably more important than professors’ attitudes, this finding does not necessarily support the argument that higher education cannot reverse potential negative impacts of K-12 education. First, we know neither the nature nor the magnitudes of impact of K-12 education. As discussed earlier, the wording of the only survey question that attempts to gauge the impact of K-12 education is somewhat misleading. Many students equate their pre-college experience not with formal schooling but with particular individuals who have had distinct impact on their thinking modes, which obscures our understanding of the particular effects of K-12 education institutions. More importantly, this research gauges the impact of the current state of policy
implementation. As illustrated in this section, there are substantial shortcomings in university-level implementation that curtail policy effectiveness. Therefore, it is possible for seamlessly implemented initiatives to counteract or even neutralize the negative impact of K-12 education. To validate this statement, future research needs to examine two components. First, it needs to determine the institutional impact of K-12 education on students’ development of creativity and critical thinking. Furthermore, it needs to incorporate changes in university investment in resources that college students find helpful, and investigate how these changes affect students’ innovative potentials.

Future Research Directions

Equity and Excellence

This research uses a relatively lax standard of policy effectiveness. I examined only the existence of improvement in students’ innovative-thinking abilities. Other aspects of policy effectiveness warrant further exploration. The first aspect is cost-effectiveness. A student at Fudan University commented on the tremendous sacrifices under the current system to accommodate the rise of the brightest few:

The evaluation system in China is sad....What the government is doing can only facilitate the development of a select few top talents through crash-course-like training, and all of the rest of the talents, which are deemed not worthy of receiving excellent education because they scored slightly lower than those top talents, are lost. The resources and projects developed by universities are intended for elites (jingying fenzi), and I'm not sure if you noticed this, but the so-called innovation cultivation in China is mandated from above, whereas innovation cultivation in the United States is coupled with individuality. It's as if without government input we
cannot achieve anything....If we want to be able to cultivate a lot of innovative talents who are also willing to stay in China, we should start cultivating them from a young age.

In other words, this student noticed that the spread of gains in innovative pursuits is far from uniform. If a system constantly filters for the brightest to receive the best resources, it can be cost-ineffective. Students who learn more slowly but could have uncovered innovative potentials may lose confidence and give up along the journey of incessant competitions.

Two types of students usually arise from this massive pool of neglected students. One type of students internalizes the defeated identity imposed by the system and either stops trying their best or strives only for an acceptable score range to appease their parents. The other shuns evaluations in the system and continues in-depth self-discoveries independently. While the latter maintains passion for learning and may proceed to generate innovative ideas, their growth cannot be attributed to the education policies in China. In other words, some students perceive the current education system as incapable of systematically developing a large quantity of innovative talents. If we consider the cost of university investment per talent, the small pool of students who are both capable and willing to realize innovative breakthroughs will exaggerate the figure, rendering current policies costly.

While not advocating elimination of competitions altogether, I speculate that promoting both excellence and equity can significantly enhance policy effectiveness. That is, knowledge should be taught in a way that accommodates more advanced pursuits for some without suppressing the willingness to learn for
all. This can be done by teaching fewer facts and emphasizing methods more. The former can lighten the burden of memorization; the latter equips students with the ability to derive knowledge themselves, which can make learning an easier, more fun, and more self-reliant process. Both practices promote equity. By learning to relate different concepts and infer patterns from facts, students can derive the same knowledge that they would have to memorize under the rote memorization scheme. As such, less dependence on rote learning does not affect the amount of knowledge students learn. In addition, rote memorization makes learning more difficult over time. If the grasp of knowledge is built upon memorization instead of comprehension, students are less likely to understand more complex concepts that they encounter in subsequent schooling, which makes learning an increasingly unpleasant task. In contrast, a good grasp of methods makes future learning easier; students can leverage strengthened analytical abilities to disentangle difficult concepts. Therefore, a method-centric learning path helps retain more students’ interests in learning. Coupled with enhanced learning capabilities, a positive attitude toward learning boosts the likelihood that a larger number of students will continuously perform well rather than being eliminated by competitions and deemed unworthy of further cultivation. A more uniform spread of intellectual aptitudes will result, thus leading to enhanced equity and excellence.

Despite the validity of this analysis, we should remember two things. First, teaching methods is only one of the many plausible strategies for promoting both equity and excellence. Furthermore, the inherent conflict between the two goals
will persist as long as resources are limited. As a result, helpful strategies may only *diminish* without *overcoming* their conflicts. Future studies in this area should explore the pros and cons of alternative solutions and develop a rigorous framework for measuring cost-effectiveness of education policies.

**Impact of Politics**

Another area of research is society’s influence on college students’ reception of innovative thinking. Here, society refers to the overall societal atmosphere, which according to some scholars is largely dominated by politics. Zhao Litao and Zhu Jinjing stated that bureaucratization (*guanliaohua*) has been singled out as the root cause of major problems in China’s higher education system; the institutional setup within public universities makes them look like government agencies. 56 This observation corresponds to another critique mentioned in the literature review: namely, that government officials consider the position of university president to be a stepping stone toward promotion. Given that university leaders have a considerable amount of discretion in allocating government funding, whether their political aspirations influence their decisions on resource investment—and indirectly affect the cultivation of innovative talents—is worth further contemplation.

Another aspect of politics may directly affect students’ inclination to develop innovative thinking. Student interviewees reported that obtaining Chinese Communist Party membership helps with their post-graduate job search. In other

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56 Litao Zhao and Jinjing Zhu, *China’s Higher Education Reform: What Has Not Been Changed?* (Singapore: East Asian Institute, National University of Singapore, 2010), i.
words, the CCP incentivizes party loyalty—at least in appearance—with its insurmountable power network, which opens doors to some of the more lucrative employment organizations in China. Since incentives shape behavior, benefits associated with party membership create a culture of induced obedience. Ironically, this government-desired mentality contradicts the core of innovative thinking. As defined, innovative thinking embodies critical evaluation of existing paradigms and a willingness to modify or even overturn them in favor of generating better ideas. In other words, having the courage to change is key. As a result, the concept of innovation can be at odds, if not incompatible, with that of loyalty. Given our earlier discussion that future goals factor into students’ inclination to cultivate innovative thinking, it is doubtful that innovative capabilities can develop when career development calls for conformity. While this research examines the government-university relationship, it evaluates the government’s impact through the lens of policies rather than politics. Therefore, additional research is needed. In other words, we need a fact-based understanding of whether rigidity in political ideology compromises the freedom of academic research and dampens students’ motivation to pursue innovative thinking; if so, to what extent. Subsequent findings can be highly valuable: they inform us whether mere policy reform without altering the foundation of a political regime is effective.

Ultimately, a certain degree of university autonomy might facilitate the sustainable development of innovative talents. In November 2011, the Ministry of Education announced plans to gradually eliminate majors producing
unemployable graduates. It will soon start evaluating college majors by their employment rates and resize or cancel programs in which the employment rate falls below 60 percent for two consecutive years. Such a high-handed and result-oriented approach inevitably renders any in-depth exploration of a field risky. Students have to check their passion for a certain subject against the practicality of their major selections. Under this new policy, even students who are determined enough to enroll in a field despite lack of pragmatism may encounter abrupt evaporation of faculty support or research resources, which forces them to abort their original pursuits. If innovative talents can be cultivated at all in this scheme, they might only occur in fields that the government deems worthy of investment.

The dilemma created by this new policy direction is similar to that of political influence. More importantly, this impending policy highlights the essential characteristic of the government’s pursuit of innovation: the state attempts to optimize the contribution of individuals to its objectives regardless of their will. It either offers positive incentives to induce changes in behavior or compels compliance through punishment or restrictions. Since the government cares deeply about the economy, two questions are worth pondering. The first is whether a sacrifice of the breadth of innovation development impacts its depth. That is, downsizing the range of majors offered might suppress some students’ inclination to develop innovative thinking and prevent further growth in innovative potentials. More broadly, we need to understand whether extensive

top-down interventions impact college students’ reception of innovative thinking. As discussed earlier, many survey respondents voiced a desire for independent initiatives and freedom of exploration. If college students start perceiving innovative pursuits as externally imposed instead of internally desired, their passion may subside. As such, few would uncover their innovative potentials, the government’s actions would backfire, and the CCP may face a situation pithily described by a Chinese proverb, “haste makes waste” (*yusu ze buda*).

**Alternative Research Angles**

Comparative studies, an approach not employed in this research, are an effective way of gauging policy effectiveness. The number of overseas Chinese college students has grown and is predicted to grow consistently. Therefore, we can isolate the impact of higher education policies by comparing these students with their fellow students who share the same K-12 education backgrounds but attend domestic universities. United States is a particularly suitable comparative target for two reasons. First, United States is one of the most popular study-abroad destinations for Chinese students. The vast student population makes data collection convenient. More importantly, U.S.-based universities form the largest percentage of renowned universities in the world. According to *U.S. News*, 21 percent of the top universities worldwide are in the United States. Given that

60 “World’s Best Universities: About the Rankings,” last modified October 18, 2011,
rankings represent the composite quality of education, it is intriguing to see whether the general strategies employed by American universities indeed develop innovative talents more effectively than Chinese universities do.

Besides examining universities in different countries, we can compare the roles of different types of universities in China. This research only addressed the facilities and resources at public universities; private universities (minban daxue) may have different management styles and take distinct paths in cultivating innovative thinking in college students. In particular, Southern University of Science and Technology (SUST) is worth systematic investigation.

As discussed in the literature review, SUST is a comprehensive research university built two years ago with a focus on science and engineering, as well as a mission of experimenting with novel modes of cultivating innovative talents. As an atypical school, SUST maintains an amiable yet ambiguous relationship with the MOE. The MOE approves the existence of the university but does not provide it with financial support as it does 211-Universities. Similarly, while SUST strives to maximize academic freedom for its faculty and students by fighting bureaucracy, it is subject to strict government surveillance on student enrollment. In the midst of discreet explorations, SUST nonetheless has kept its promise of accommodating students’ cultivation of innovative thinking in holistic ways. Conversations with four SUST students, who are now sophomores, confirmed that the university has strengthened students’ capacity for developing


innovative potentials. According to them, the school has met or exceeded their expectations in terms of the caliber of professors, quality of professor-student interactions, research facilities, rigor of taught knowledge, and peer discussion atmosphere. The school excels particularly in the last criterion since the students it admitted share a passion for knowledge and willingness to challenge themselves. Based on the hypotheses of this research, SUST may successfully nurture innovative talents. Of course, we cannot yet draw a conclusion given highly variable policy landscapes and the youth of the university. Nevertheless, a thorough research on the evolution of the university can be tremendously beneficial: we can better understand the factors that facilitate innovative thinking and the corresponding role that the government and policies would play.

Lastly, this research uses incentives as a framework of studying students’ adoption of innovative thinking habits. Resources nearby and career goals are treated as external and immediate incentives, whereas pre-college influences are conceived as internal and entrenched incentives. Undoubtedly, other angles—such as social norms, cognitive habits, and identity—are equally plausible for exploring the underlying impetus for students to improve their innovative thinking skills. Therefore, future research may consider employing a more psychological or sociological approach in understanding college students’ behavior toward innovation-driven policies.

**Study Limitations**

Besides alternative research approaches, this study may yield more
accurate insights with several improvements. While a sample size of 462 students is sufficient for meaningful statistical analyses, non-randomized sampling and a primary focus on economically developed cities may skew the results and make generalization of findings difficult. In particular, the ratio of 211- and non-211-Universities in this research is significantly higher than the actual ratio for the nation. Future studies should therefore consider outreach to students in more remote regions in China in a more randomized manner.

In addition, “astute thinking abilities” and “creative thinking” are treated as interchangeable with “innovative thinking” in survey question design. As discussed, this is appropriate only for gauging the direction of influence of current policies. To understand the magnitude of policy effectiveness, future research should consider standardizing participants’ definitions of the term by asking specifically about each respondent’s understanding of this concept.

Future research can also include the perceptions of graduate students. In fact, graduate students might be a more suitable study target since policy documents explicitly recognized the strategic importance of cultivating middle-aged scholars. Furthermore, graduate students might benefit more directly from current innovation-driven policies given a greater accumulation of knowledge than college students and a relatively small population. Therefore, a study of their attitudes toward innovative thinking can broaden the context of understanding the effectiveness of higher education policies.

Incorporating additional data can also enrich the findings of this study. While we have considered the potential influence of non-institutional factors—
namely, career orientation and pre-college exposure—there might be other variables that might confound the relationship between university resources and college students’ innovative potentials. The majority of the comparisons in this research focus on differences between students in different types of universities; within each category of universities, students are treated as a homogeneous group rather than distinct individuals. Therefore, controlling for individual-level differences such as academic abilities and socioeconomic backgrounds can buttress our understanding of the effectiveness of university investment. Due to the time and resource constraints on this research, the potential impact of this new group of variables is not explored, yet it is suitable for extended research on the topic of innovative thinking.

Lastly, self-reporting invariably entails bias. I do not expect that all survey respondents were completely truthful in their responses, and there can be a shared mentality on masking authentic attitudes for certain types of questions. A good understanding of the Chinese culture and language can help elicit honest answers from potentially “image-conscious” Chinese students. That said, I am confident that most of the survey questions in this research are worded either objectively or subtly enough to invite detached, and thus hopefully authentic, responses.

Conclusion

Despite the limitations of this research, we have found solid evidence to support the hypothesis that while current university investment is helpful toward enhancing students’ capacity for innovative thinking, it is insufficient. To realize
the development of innovative talents, universities need to supplement current resources with adequate infrastructural support that enables and incentivizes the utilization of these resources. Even though attitudes toward learning tend to form in earlier stages of life, reform on higher education alone can still positively shape students’ inclination to embrace alternative perspectives and brainstorm uncommon solutions. In the end, the success of any reform lies in the alignment of different stakeholders’ internal and external incentives. Students will adopt innovative thinking habits when they are consistently signaled—directly or indirectly—that such a behavior is compatible with their well-being or contributes to their long-term success.
Appendix A1: Original Survey for Chinese College Students

中国大学生问卷

若无标明，每道题请填一个答案。若觉得多个答案合适，挑最喜欢的那个就好。
谢谢参与！

学校：
年级（刚读完大几）：
专业：

出生地：
户口所在地：

1. 您眼中成功最重要的元素是：
   A. 物质满足
   B. 权力
   C. 知道自己要什么并达成梦想
   D. 精神满足
   E. 其他（请标明）：

2. 您认为大学前教育对您创造性思维有没有影响？
   A. 极大负面影响
   B. 负面影响
   C. 没影响
   D. 正面影响
   E. 极大正面影响

3. 哪些人对您的思维习惯影响最深？
   A. 父母
   B. 老师
   C. 同学或朋友
   D. 同事
   E. 其他（请标明）：

4. 基于第三题，这些人对您提出不同看法的包容及鼓励程度是？
   A. 相当低
   B. 较低
   C. 不鼓励也不打击
   D. 较高
   E. 相当高

5. 在大学课堂及课后讨论中，您对与您看法截然不同的人一般的态度是：
   A. 加以反驳
   B. 不予理睬
   C. 敷衍了事
D. 认真聆听
E. 深入交流

6. 您认为您的教授对学生提出不同看法的普遍包容及鼓励程度是？（   ）
A. 相当低
B. 较低
C. 不鼓励也不打击
D. 较高
E. 相当高

7. 您认为以下哪些因素有效帮助了您培养创造性思维？（多选）
A. 师生互动频率及质量
B. 先进科研设施
C. 课外实践机会
D. 课外自由讨论氛围
E. 完成独立项目的机会
F. 灵活的教学方式
G. 其他（请标明）

8. 您认为您的大学在上述哪些方面投入充足？（多选）
A. 师生互动频率及质量
B. 先进科研设施
C. 课外实践机会
D. 课外自由讨论氛围
E. 完成独立项目的机会
F. 灵活的教学方式
G. 其他（请标明）

9. 您觉得在你们学校，作弊是个普遍的现象吗？（   ）
A. 没人作弊
B. 没什么人作弊
C. 有一部分人作弊
D. 很多人作弊
E. 绝大多数人作弊

10. 您觉得学生作弊最根本的原因是：（   ）
A. 道德底线太低
B. 懒惰，不愿意学习
C. 不想挂科
D. 作弊代价太轻
E. 其他（请标明）

11. 您当初选专业最根本的考虑是：（   ）
A. 兴趣浓厚
B. 工作前景
C. 被录取概率
D. 家人或朋友的影响
E. 服从分配
F. 其他(请标明):

12. 大学这几年您哪些方面得到了较多锻炼？（多选）
A. 实用知识或专业技能
B. 思考及分析能力
C. 人生态度
D. 情感或社交圈子
E. 领导才能培养
F. 自我认知
G. 其他(请标明):

13. 毕业后有什么打算？（）
A. 国内读研
B. 工作
C. 出国读研
D. 创业
E. 其他(请标明):

14. 若选择工作，请问您打算在什么样的单位工作？（没有选工作的请跳到第15题）
A. 中小型民营企业
B. 外企
C. 国有企业
D. 政府部门
E. 家族企业
F. 其他(请标明):

15. 基于前两题，您认为相应机构（比如说，读研的相应机构是学校）最看重的是（请排列，1为最重要）:
大学知名度与成绩（）
执行任务能力（）
专业技术或语言（）
工作态度（）
人际关系（）
个人荣誉（）
敏锐思考能力（）
其他(请标明):

谢谢参与！
Appendix A2: Translated Survey for Chinese College Students

1. In your eyes, the most important element of success is:
   A. Material rewards
   B. Power
   C. Knowing what I want and achieving my dreams
   D. Mental rewards
   E. Other (please specify):

2. Do you think the education you received before entering college has had any impact on your creative thinking abilities?
   A. Substantial negative impact
   B. Some negative impact
   C. No impact
   D. Positive impact
   E. Substantial positive impact

3. What kinds of people have had the largest impact on your thinking habits?
   A. Parents
   B. Teachers
   C. Classmates or friends
   D. Colleagues
   E. Other (please specify):

4. Based on your response to Question 3, to what extent do these people embrace and encourage your act of raising thoughts different from theirs?
   A. To a small extent
   B. To a relatively small extent
   C. To a moderate extent; they neither discourage nor encourage different voices
   D. To a relatively large extent
   E. To a large extent

5. In class or post-class discussions, your general attitude toward those who hold completely different perspectives can be best described as:
   A. Refute immediately
   B. Ignore them
   C. Respond in a perfunctory and nonchalant way
   D. Listen attentively
   E. Engage in deep discussions with them

6. To what extent do most of your professors embrace and encourage students’ act of raising thoughts different from theirs?
   A. To a small extent
   B. To a relatively small extent
   C. To a moderate extent; they neither discourage nor encourage different voices
   D. To a relatively large extent
   E. To a large extent
7. Which elements below do you think can effectively help you cultivate innovative thinking (select all that apply)?
A. Frequency and quality of professor-student interactions
B. Advanced research facilities
C. Internship opportunities outside of academics
D. Free discussion atmosphere outside of class
E. Opportunities to undertake independent projects
F. Flexible teaching methods
G. Other (please specify):

8. Which of the resources below do you think are sufficiently present at your school (select all that apply)?
A. Frequency and quality of professor-student interactions
B. Advanced research facilities
C. Internship opportunities outside of academics
D. Free discussion atmosphere outside of class
E. Opportunities to undertake independent projects
F. Flexible teaching methods
G. Other (please specify):

9. Do you think that plagiarism is a prevalent phenomenon at your school?
A. No one plagiarizes
B. Few plagiarize
C. A portion of students plagiarize
D. Many students plagiarize
E. The vast majority plagiarizes

10. What do you think is the most fundamental reason for plagiarism at your school?
A. Moral baseline is too low
B. Laziness and reluctance to study
C. Students do not want to flunk a course
D. Punishment for plagiarism is too light
E. Other (please specify):

11. Your most fundamental reason for choosing your major is:
A. Strong interest in the subject
B. Employment outlook related to the major
C. Probability of being admitted to the university
D. Influence by family or friends
E. Acquiescence to university arrangements
F. Other (please specify):

12. In what areas do you think you have made significant improvement during college?
A. Technical knowledge or skills
B. Thinking and analytical abilities
C. Attitude toward life
D. Socialization
E. Leadership
F. Self-perception
G. Other (please specify):
13. What is your post-graduation plan?
A. Attend domestic graduate school
B. Work
C. Attend overseas graduate school
D. Entrepreneurship
E. Other (please specify):

14. If you chose “work” in the previous question, what types of institutions would you like to work for? (skip to the next question if you did not choose “work” for Question 13)
A. Small- to medium-sized private enterprises
B. Multi-national corporations
C. State-owned enterprises
D. Government sector
E. Family business
F. Other (please specify):

15. Based on your answers to the previous two questions, what characteristics or credentials do you think corresponding institutions value in applicants (please rank the following factors, with 1 indicating the most important criterion)?
A. Prestige of university and GPA
B. Ability to execute assigned tasks
C. Technical knowledge or language skills
D. Attitude toward work
E. Personal network
F. Honors and awards
G. Astute thinking abilities
H. Other (please specify):
Appendix B. Codebook

Dependent Variables:

Q5=Attitudes toward those with entirely different views
1=A. Refute Immediately
2=B. Ignore them
3=C. Respond in a perfunctory and nonchalant way
4=D. Listen attentively
5=E. Engage in deep discussions with them

Q12=Areas where students perceive they have made significant improvement
1=whoever chose B, thinking and analytical abilities, regardless of what else they chose
0=those who did not choose B

Q7Q8=inferred innovative thinking capacity=sum of interaction between question 7 and question 8, where students choose what factors they think are important to fostering innovative thinking (in question 7) and then what they perceive as available at their universities (in question 8).

Each option is listed as an independent variable. When a student chooses that variable, it is coded as 1; otherwise, it is coded as 0. I then multiply the numbers that independent variable received for question 7 and 8, which is 1 only if the student chose that variable for both questions. This variable is the sum of the products of the 7 independent variables. The underlying assumption is that the more resources students find useful and available at their universities, they more likely they have the capacity to build innovative thinking, which is therefore represented by a higher sum of interaction variables.

Independent Variables

Category One: University Resources

Q7a=A. helpfulness of frequency and quality of professor-student interaction
Q7b=B. helpfulness of advanced research facilities
Q7c=C. helpfulness of internship opportunities
Q7d=D. helpfulness of free discussion atmosphere outside of class
Q7e=E. helpfulness of opportunities to undertake independent projects
Q7f=F. helpfulness of flexible teaching methods

Q8a=A. availability of frequency and quality of professor-student interaction
Q8b=B. availability of advanced research facilities
Q8c=C. availability of internship opportunities
Q8d=D. availability of free discussion atmosphere outside of class
Q8e=E. opportunities to undertake independent projects
Q8f=F. availability of flexible teaching methods
All variables above are coded as 1 when chosen and 0 when not chosen.

Q6=professors’ attitudes toward different opinions raised by students
1=A. to a small extent
2=B. to a relatively small extent
3=C. to a moderate extent
4=D. to a relatively large extent
5=E. to a large extent

Q9=perceived prevalence of plagiarism
1=A. no one plagiarizes
2=B. few plagiarize
3=C. a portion of students plagiarizes
4=D. many students plagiarize
5=E. the vast majority plagiarizes

Q10=perceived most fundamental reason for plagiarism
1=D. Punishment on plagiarism is too light
0=A. Moral baseline is too low or B. Laziness or C. Fear of Flunking a Course

Category Two: External Incentives (Career or Development Objectives)

Q1=perception of success
1=A. material rewards or B. power
0=C. knowing what I want and achieving my dreams or D. mental rewards

Q11=fundamental reason for choosing your major
1=B. Employment outlook, C. probability of being admitted to the university, D. influence by family or friends, or E. arrangement by the university
0=A. Strong interest in the subject

As discussed in the survey design section, choices B, C, and E indicate that students are practicality-driven and therefore more concerned with external incentives. Although choice D does not exactly fit this category, it resembles the other choices in its orientation with external influence. Furthermore, family influence in many occasions is centered on the utility of a particular major (i.e. how likely it will bring students stable jobs or high incomes), so I argue that choice D is comparably practical.

Q13=post-graduation plan
1=D. Entrepreneurship or C. Overseas graduate school
0=A. Domestic graduate school or B. Work
Q15=ranking of importance of different skills for future development

Quite a few responses ranked multiple variables as “1,” which indicates that students had difficulty picking among these variables. In addition, some students did not rank all variables and only put “—” next to those they view as the most important. Considering these two conditions, any responses that ranked “astute thinking abilities” as a “1” were coded as “1” and “0” otherwise.

Category Three: Socialization

Q2=perception of impact of pre-college education
1=A. Substantial negative impact
2=B. Some negative impact
3=C. No impact
4=D. Positive impact
5=E. Substantial positive impact

Q4=encouragement of different ideas by people whom students perceive as having the largest impact on their thinking habits.
1=A. To a small extent
2=B. To a relatively small extent
3=C. To a moderate extent
4=D. To a relatively large extent
5=E. To a large extent
Appendix C1. Original Interview for Chinese College Professors

国内大学教授采访

任教学校: 任教领域:

1. 您认为你们学校的教授普遍面临着什么压力？

2. 作为一个教授，您认为自己的发挥空间充足吗？主要体现在？

3. 就您对 XX 大学的了解，学校经费主要来源是？

4. 学校一般会把经费花在哪些方面？

5. 您认为要培养学生的创造性思维，学校应该在哪些方面作更多的投资？有哪些方面有待改善？
Appendix C2. Translated Interview for Chinese College Professors

University:  
Area of Expertise:  

1. What kinds of pressure do you think professors at your university face in general (time allocation among research, teaching, and other tasks required of a professor)?

2. As a professor, do you feel that you are given enough autonomy in designing courses or undertaking research? Please provide an example.

3. Based on your understanding what are the major funding sources for the university where you teach?

4. How does your university use its funding? Does it invest more heavily on research facilities or infrastructural support?

5. To cultivate students' critical thinking abilities, what aspects do you think the university should invest in more heavily?
Appendix D. Complete List of Universities Represented in this Study

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VII. Bibliography


