

UW-SICHUAN EXCHANGE

Final Research Proposal

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An Institutional Economics Analysis of Information Communication Technology (ICT) and China's Gaokao (National College Entrance Examination)

ABSTRACT:

Within the framework of institutional economics this research will seek to identify and quantify a relationship between the use of Information Communication Technology (ICT) by Chinese high school students and their performance on the Gaokao, a standardized national exam. For the course of this research I will define ICT specifically as networked computers with a degree of Internet access, and ICT usage as any activity involving networked computers. The outcome variable, the hypothesized dependent variable, is student scores on the Gaokao (National College Entrance Examination). The Gaokao is an important social institution in China, it is widely accepted as a metric for student aptitude and in some cases is the only measure of the educational quality of schools and individual teacher performance. It is further hypothesized that ICT usage by Chinese students represents a statistically significant set of explanatory variables, explaining a portion of the variance in Gaokao scores between students. ICT usage as a variable is divided into two stylized categories (formal and informal), each representing a vector of independent variables that capture the typical

usage pattern of individual students. Formal ICT usage is defined as all activity using a networked computer that is initiated with the explicit purpose of advancing learning or to assist in completing an educational task: use of school computer labs, use of computers as part of classroom curriculum, use of computers to assist in homework. Data points on these variables of formalized ICT usage will be collected by student and teacher survey and ethnographic studies of a few high schools as case studies. Informal ICT usage can be defined as the converse to formalized ICT usage, all activity using network computers that students engage in without an explicit educational purpose or as assistance in completing an educational task: use of computers to chat with friends, use of computers for online gaming, use of computers to browse news information for entertainment. Surveys of students, and as a secondary source young patrons in internet bars, together with ethnographic studies of specific high schools and/or individuals will comprise the data set for the vector of independent variables that comprise informal ICT usage. It is expected that for most Chinese students informal ICT usage will greatly outweigh formal ICT usage. All data will be analyzed using econometric methods, the ethnographic conclusions employed as inputs and controls, to form a matrix of ICT usage comprising each of the variables of informal and formal ICT usage and listing the power of each to explain variation of Gaokao scores. This research I believe will have very practical implications as China is currently undergoing a massive educational restructuring, consolidating schools and trimming budgets, this research could better assist school administrators in targeting particular investments in ICT that could raise the Gaokao scores of students and subsequently vastly improve their educational opportunities. **This abstract is very complete, and it makes the problem and your methods clear. But for**

translating and passing on to SU, I need a shorter version. Please try to get me one that will fit on one double-spaced page or half a single-spaced page. I'll have it translated and passed on as soon as you can get it back to me.

BACKGROUND / MOTIVATION:

The economic growth of China over the past quarter-century has been a spectacle unprecedented in modern history; consistent double-digit growth rates have lifted millions out of extreme poverty and literally reshaped the landscape of China. China's rapid economic growth speaks to a fundamental issue that is present in my intended research: important institutions of social coordination adjusting to the new norms and conventions that arise due to rapid social change brought about by intense economic and human development. Education as an institution in China has been subject to strain during this period of change (Hasmati & Yang, 2006 ; Ma et al., 2003) . Unlike most other social institutions, the effects of changes to Chinese educational institutions can be observed with relative objectivity. Or at least rather neat quantifiability. Objectivity gets us into epistemological realms we'd best stay out of if we want to get this work done. Chinese education as an institution is guided by centralized policymaking, has well-defined goals, and uses widely accepted metrics of success; the Gaokao as a social institution captures all these elements of Chinese education (Yu & Suen, 2005 ; Potter et al., 2004).

The term Gaokao, is an informal nomenclature for the National College Entrance

Examination (NCEE). This high-stakes national standardized exam is taken by all of China's high school seniors that wish to gain acceptance at an institutional of tertiary education. The practice of centralized examination has its roots in ancient Chinese culture and is one cause for high value of education in China and fervor of Chinese students for disciplined study. As early as 603 AD, during the Sui Dynasty, China established a defacto institution of public education under the 'civil examination system.' The civil examination system allowed anyone male, peasant or noble, to sit for a standardized essay based exam. Performance on the exam was the leading criteria for appointment to a highly sought-after government position (Yu & Suen, 2005 ; Feng, 1994). Furthermore, adequate preparation for the exam required only diligent self-study in the philosophy of highly accessible ancient Chinese literature, the so-called Four Books and Five Classics. This merit based system received support from peasants as performance on the civil examination became strongly associated with family aspirations for upward social mobility. This cultural legacy of centrally administered standardized examination was one of the reasons for the establishment of the Gaokao in 1958 (Rotberg, 2004 ; Feng 1994).

Under the central administration of the Ministry of Education (MOE), the Gaokao has been an annual ritual for high school seniors in China with the exception of the period encompassing the chaos in education during the Cultural Revolution. China's current primary and secondary student enrollment population is nearly 320 million, more than the entire population of the United States (Rotberg 2004). Although the number of universities and colleges has increased since 1978 there still remains fierce competition

among students for acceptance, especially to those institutions regarded as highly prestigious. Given the enormous number of annual applicants and the fact that university admission rates are determined at the MOE headquarters in Beijing, simple bureaucratic process dictates that the Gaokao be the only measure of student aptitude, the primary determinant of student placement at university, and subsequently, a very important factor to future individual success (Yu & Suen 2005 ; Meier & Stiglitz, 2001).

Since the 1990's the Gaokao has consisted of four parts, a so called '3 + X' system. Three basic subjects of examination have been the same for decades, Chinese Language, Foreign Language, and Mathematics. The X portion of the exam is a choice between the topics of either comprehensive Art or Science, this is decided when the student declares to be seeking a degree in either liberal-arts/social-sciences or in hard sciences, such as engineering and biology. Student scores on these sections are on scale of 0 to 900, and are ~~singular~~ the sole basis for qualification or immediate ~~ly~~ disqualification for consideration at certain universities. Each university is assigned by the MOE a 'bottom-line score' for which only students meeting that Gaokao score can be legally considered as candidates for admission (Yu & Suen, 2005). The bottom-line score is set by the MOE so that there is only a small number more candidates for admission than there are admission slots, allowing a very small degree of discretion by provincial level bureaucrats in charge of admissions. Naturally, the more exclusive, so called 'key universities,' have higher bottom-line scores (Yu & Suen).

Although the candidate allotment system is highly formulaic it is also highly

segmented based on geography, which high school a student attended, and specially recognized talent and minority status. For instance, the MOE assigns a quota of how many students to accept at a specific university from a specific province. This number varies to ensure that provinces with better students receive more admission slots; performance of last year's students on the Gaokao is the only metric to inform this centralized decision-making process. However, although the MOE determines the quota level, provincial administrators select the candidates that win admission. There are no quotas for the distribution of admission slots within provinces, and admissions can be highly skewed towards specific high schools amongst the urban centers; the Gaokao is the only objective measure of high school performance. In addition to making admission decisions based upon Gaokao scores, provincial administrators have the ability to slightly influence scores under the 'points-added system.' Such a system allows for minorities, Chinese from abroad, and especially talented athletes to receive a small number of additional points on their Gaokao exam (Yu & Suen). Naturally, the points-added system is a point of contention for many Chinese that do not receive the benefits of the program, and abuse of the definition of students eligible for added points is believed to be widespread (Yu & Suen). **Interesting. I wonder what they mean by "abuses"** The fact that Chinese education officials choose to correct for disadvantaged persons via such formulaic means is a testament to just how much importance the Gaokao holds as a determinant of individual educational futures. **I'm learning a lot from reading your introduction here. I had never before explored the details on how it works.**

Although the Gaokao remains very much a centralized educational institution,

funding for individual schools has increasingly become a non-centralized responsibility. Local officials must substitute resources from economically profitable activities to support educational infrastructure. The familiar circumstance of tighter budgets and increasing enrollment has forced a wide-scale restructuring of schools: private schools are more common and public schools are larger but less dispersed (Chan, 2007). However, under a mandate to provide quality education, educational institutions must perpetually increase teaching efficiency to continue to produce high-scoring students. The institution of education in China is a dynamic one, within which many variables, ICT usage among them, have the potential to play a salient role in shaping educational outcomes (Weixin, 2006 ; Zhao, 2005).

Information Communication Technology is already making its presence felt on the landscape of Chinese society. Amazingly, China is set to overtake the United States as the leading country in the world for broadband Internet subscribers at 42 million persons. This growth has been robust even though the government tightly regulates the three major Internet Service Providers in China. Networked computers (ICT usage by my definition) are widespread in urban centers, but lacking in rural areas. In 2001, only 0.8% of China's Internet users were of rural residence status (Chen, 2001). There has been little study on what effect that ICT usage may have upon Gaokao scores. This is in part because the Gaokao emphasizes the ability of students to reproduce knowledge from memory and compose essays with only pencil and paper. High school assignments, which often mimic the content of the Gaokao, are structured similarly so that computer proficiency is not necessary and not encouraged to perform well in school (Rotberg, 2004). In contrast, national studies conducted in the United States have shown a

significant correlation between math scores on standardized tests and ownership of a personal computer (Attewell & Battle, 1999). **Of course, that will diminish as computer ownership becomes nearly universal in the US.** Furthermore, some educational districts in the United States have taken to providing a laptop to each student to emphasize computer-aided learning and achievement. In the context of the United States educational system there exists significant evidence to contend a relationship between improved student performance and ICT usage; such a statement cannot be made in the context of China and the Gaokao at this time. **So, you need to add a sentence here that says, "I'm going to fill in the gap."**

As established above, educational institutions in China are dynamic places of change in regards to policy and inputs; however, the socially agreed upon metric of institutional performance is stable: student test scores on the Gaokao. Under these circumstances my research will explore a hypothesized relationship between Information Communication Technology (ICT), as a relatively new and dynamic element in Chinese society, and the important entrenched social institution of the Gaokao.

RESEARCH QUESTIONS:

There are a great many questions and conclusions that can be asked and reached from the datasets that I plan on gathering. The more prominent questions that I hope to answer are listed here. There are two types of research question, each pertaining to the two types of ICT usage (formal and informal) and the corresponding vectors of independent variables. Formal ICT usage is defined as all activity using networked computers as a part of a

concerted educational plan or towards completing a task related to education. Informal ICT usage is all ICT usage that occurs outside the educational environment and without any apparent educational intent, a common examples would be internet gaming, email use, instant messaging, blogging, [list all the common ones].

Is there a quantifiable relationship between formal and/or informal ICT usage and student performance on the Gaokao, if so what is it?

This question is straightforward, a snapshot of the current typical ICT usage profile of students and total effect of such usage upon educational performance. Such a snapshot is mostly just a mechanical exercise of properly collecting, controlling, and analyzing the data. The goal in answering this question is to create a matrix of ICT activities to test for correlations between the usage variables and the outcome variable, test scores. This should yield a very grainy picture of the potential for ICT to influence educational outcomes. Also, with refined enough categories of usage, I should be able to identify particularly strong or interesting phenomena (e.g. internet chatting contributing to higher test scores). These particular usage categories which the preliminary data reveals to be most interesting can be examined further and more qualitatively using ethnographic techniques. Ultimately, this type of matrix would be extremely helpful to educational administrators who must decide how to allocate budgetary resources most efficiently. Important to consider at this juncture are the control variables of the survey instrument, which will be discussed under the Research Methods section. Nice.

Is there a discriminatory element to the formal and/or informal ICT usage and student performance on the Gaokao?

Whereas the previous question had no emphasis upon the informant beside his/her ICT usage profile and standardized test score, this question aims to control for socio-economic disparities between informants. By collecting just a limited socio-economic profile of informants, and then comparing that with ICT usage profiles and the outcome variable of test scores, some important caveats to the conclusions of the first question may very well emerge. For example, the influence of ICT may be biased or more pronounced in regards to urban areas, particular schools, or non-minority status.

Answering these questions is much more difficult, requiring a much more detailed picture; therefore ethnographic studies following the preliminary data analysis will be an essential guide, narrowing the focus to specifically interesting effects which can be re-examined in finer detail statistically and at more depth ethnographically. The power of any solution to this question will depend mostly upon how comprehensive a socio-economic profile can be extracted from informants. Certainly, such a profile would include the elements of: hometown, high school, race, gender, age, intended major, primary and secondary language, and education level of parents. A strong answer to this question will refine further the typical ICT usage profile of Chinese students, allowing administrators to target specific geographic regions or economic zones that would yield the greatest educational benefit from ICT investment.

Which specific activities, under both formal and informal ICT usage, are most significant

in explaining variation in student performance on the Gaokao?

Given the data collection and analysis process discussed in the previous two questions, this question is a comparison between the independent variables that comprise the two vectors of variables, formal and informal ICT usage. Essentially this question gets at the issue of whether educational performance would be best served by overt investment in ICT with specific educational purpose in mind, or if the effects of ICT usage manifest themselves naturally as students explore ICT without any guidance. Furthermore, once sensitivity testing is carried out with respect to the socio-economic profile of informants the conclusion of which type of ICT usage (formal or informal) is more significant should be variable. At this point, such phenomena could be investigated further using ethnographic techniques to provide a more comprehensive story (e.g. the effect of online chatting is weak with regards to minority informants because of the lack of website interfaces in their native language). This line of research should provide administrators with information to more specifically target types of usage and particular groups of students that require direct budgetary support in order to benefit educationally from ICT usage. **Right. As I think I said before, I would not place too much emphasis on the broadly inclusive categories of formal and informal; there may be specific types of usage within these broad categories that are most significant.**

What is the return to scale of ICT? Can a time series sensitive return to ICT be extrapolated? Can a scalable model be constructed?

The solution to this question is a mathematic model, an entirely econometric exercise which depends greatly upon the power of the data collected. The detailed ethnographic studies employed as a part of the previous three questions would serve as a guide in constructing and testing the accuracy and reasonableness of such a model. The strength of the model could be augmented by taking into account exogenous economic variables such as GDP growth, ICT as an industry growth, or aggregate connectivity, which may introduce a time series or forecasting ability to the model. Several iterations of the baseline model could be developed to reflect different assumptions about demographics, economic growth, or school structure. Such a model could be a useful planning tool, allowing administrators to discern between what may be temporary or permanent effects of ICT, resulting in more accurate budget predictions. Additionally, testing the forecasts of such a model would further test the efficacy of the conclusions to the previous research questions.

RESEARCH METHODS:

This research will emphasize two techniques, statistical inference as apart of econometric methods supported by empirical observation through ethnographies. The research will be carried out sequentially in four phases: Preliminary Testing (before departure), Initial Surveying, Preliminary Analysis and Targeted Ethnographies, and finally Model Building and Conclusions (post-departure). The instrument for data collection will be the college student survey. This survey, designed and tested in Seattle, will establish an ICT usage and socio-economic profile for the informant. The survey will measure current

usage patterns, and ask respondents to recall usage specific to their last year in high school (immediately before the college entrance exams). These data will be briefly analyzed so as to determine the scope of the ethnographic studies. **Need to get going on this right away, before the SU students go home in early July.**

Controlling Variables and Isolating Effect:

Of the utmost importance when conducting any research that is asking as much of its survey instrument as is this research is consideration for controlling variables. There is a healthy amount of literature regarding controlling for educational outcomes, most of which has been done in the context of the United States. Some of the controlling variables that are appropriate for the United States are not appropriate for the context of China. However, for the sake of consistency and the possibility of future comparative research questions my survey instrument will follow much of the same structure as that of the National Educational Longitudinal Study of 1988 and subsequent educational technology studies conducted by Paul Attewell and Juan Battle (1999). Discussed below are the controlling variables I plan to include on the survey, of course these are subject to change once the survey undergoes preliminary testing among Chinese students.

- **Urbanism and Region:** This involves simply asking the student informant to state his/her hometown, hukou status at the time of high school graduation, name of high school and the location of high school. Also for ease of my calculations I will ask student informants to subjectively declare their hometowns and high school locations to be either urban or rural. **OK, but**

beware of the simplistic urban-rural distinction. You may want to look at the concept of hierarchical regional space developed by GW Skinner, and explained fully in the article attached here.

- Gender: A simple question asking the gender of the student informant. There is a very significant evidence to suggest a difference in the benefits of ICT usage between men and women.
- Minority status: This control involves simply asking the informant to select a box identifying himself/herself as one of the officially recognized minzu of China, which together with hometown location should help identify true minority status.
- Social Capital: This control is has two parts, and is borrowed from the National Educational Longitudinal Study in the United States. One question will gauge if the parents of an informant personally know the parents of the informant's friends from high school. The second question will ask the students to recall how many times a week the informant discussed topics of school or education with parents. The time and frequency aspects of these questions are subject to change, and will likely be worded so as to require a yes/no response. This control is subject to significant revision in preliminary testing because I do not know if parent involvement in education is as variable in China as it is in the United States. **This ought to be really interesting. I don't know the answers. It will be important to pretest and revise accordingly if necessary.**
- Cultural Capital: This control will adjust for students that are particularly well

cultured and thus presumably have an advantage on the Gaokao due to such cultural activity. This is difficult to capture, but asking a frequency question regarding how many times a month the informant visited a museum (or any location of high culture) should provide a rudimentary measure of cultural capital. Furthermore, this could be augmented by asking if informants had music, dance, or art classes during high school. Clearly, this question is also subject to revision after preliminary testing. **Yes, let's think about this one. I don't think people visit museums often enough to make a difference; certainly less than here. But you can include art shows, concerts, watching educational TV, other things that would tend to get at the cultural capital question.**

- Educational Exposure: This control seeks to adjust for informants whose parents are highly educated, presuming some biological relationship effecting performance on the Gaokao. One question would ask for educational level attained or college degree achieved by both parents of the informant. Secondly, one question would ask the informant to check a box corresponding to certain educational items that could be found in home of the informant (e.g. dictionaries, books, news magazines, newspapers). These questions I expect to undergo significant adjustment in preliminary testing.
- Socio-Economic Status (SES): This control is most important because almost all research shows SES to be highly correlated with standardized test scores. Therefore to accurately isolate the effect of ICT usage on Gaokao scores one must carefully isolate the pronounced effect of SES. It is unreasonable to expect college freshmen to know the income level of their parents, **I bet that**

even junior high students know the exact income of their parents. These people are CHINESE, don't forget, totally obsessed with money. But again, pre-testing may reveal a lot. therefore in establishing a SES profile my survey instrument will rely upon asking informants to characterized their home situation (e.g. What type of consumer durables are in your home? When was your home constructed? These are good also.) A survey used by Professor Stevan Harrell for research in Panzhihua will serve as guide in wording questions. Preliminary testing will be very important in regards to this section of the survey.

Preliminary Testing:

The main objective of this phase is to design an appropriate and easily administered survey that can capture the usage and socio-economic profiles of Chinese first year college student informants. The survey will undergo preliminary testing from the Sichuan University students that are currently attending the UW. I will confer with several of these students in designing the first draft of the survey, after which those that participate in the preliminary testing will have an opportunity to offer criticisms and suggestions. The ideal survey will be 2 sides of a page and take less than 10 minutes to complete thoroughly. The questions will be posed in such a way that as many as possible are binary, simple yes/no response, to allow for easy interpretation and greater statistical power. This survey will comprise the bulk of the data points. The sample size necessary is currently unknown. However, a properly designed survey could be administered in a

classroom setting to a group 50 students, allowing for fairly easy scaling up of sample size. Using cluster analysis techniques and using as fine of demographic data that is available for Sichuan Province I believe that I control the sample so that it is representative of the student population of Sichuan Province.

Initial Surveying:

My first step in data collection will be to visit briefly some colleges and high schools of Chengdu. In these first few trips I will gauge the conditions for doing some ethnographic work at the schools and try to make as many contacts as possible for future reference. After familiarizing myself with the secondary and tertiary education system in Chengdu I will branch out, investigating schools and colleges outside of Chengdu, in the surrounding counties and more rural areas to gain an initial understanding of the differences between rural and urban education in China. I should note now that these trips are just to gain a general understanding of education in China, the locations of targeted ethnographies will be determined by the preliminary analysis of the student surveys. After this brief tour of schools and colleges, appropriate survey locations will be selected from Chengdu's 14 colleges and universities.

Preliminary Analysis and Targeted Ethnographies:

The data from the paper surveys will be entered into Excel and then transferred into Eviews 5.0 or SPSS 15 for preliminary analysis. Special attention will be given to

which high schools informants attended. Those high schools for which the student survey yielded a significant amount of data or particularly strong phenomena will be strong candidates for target ethnographies. Depending on the typical ICT usage profile that the survey data reveals it may be beneficial to survey patrons at one or several internet bars to get a better picture of the indirect effects from informal ICT usage. As a part of the targeted ethnographies I expect to conduct several structured interviews with teachers, IT administrators, and perhaps principals at the high schools to gain as a data input their subjective assessment of the total effects of ICT. Also, I will seek their opinion on the helpfulness of a mathematical model for administrative planning or if another form of presentation would have a greater influence upon their decision-making process. I will also observe many of these classes, specifically computer lab sessions, to note subjectively how ICT is integrated into the curriculum of these schools. Furthermore, I anticipate a lot of informal, unstructured contact with high schools students in which their aggregate opinions would contribute to the anecdotal portion of the evidence. If the results (blind results with no names) of the college entrance exams can be obtained for a specific high school for that year's students then survey of those students to establish an ICT usage and socio-economic profile may be appropriate to augment of the college-student data. However, my research does not hinge upon this possibility, as the college student survey will provide an ICT usage profile, socio-economic profile, and the outcome variable (test scores).

Model Building and Conclusions:

Once I am back in Seattle heavy analysis of the data will begin. All the data will be transferred from Excel into Eviews 5.0, SPSS 15, and SAS. I plan on using the data interpretation and manipulation features of SAS to explore the implications of the collected data. The ethnographies will be written up as specific and detailed case studies that will guide me in exploring the data. I anticipate that SPSS 15 will be the platform for basic statistical analysis that will provide a complementary story to the specific ethnographies. Under Eviews 5.0 I will test the data, put it in interplay with a variety of aggregate economic metrics from National Bureau of Statistics and attempt to fit a model to the data. This process will correspond with my fall (2008-2009) enrollment in a 400-level Econometrics class. I also anticipate some assistance and guidance from an economics professor in the model building process. Final conclusions will be written up and the forecast output of the model can be tested against the actual spring 2009 test results, for which aggregate data will hopefully be available.

DATA ANALYSIS:

The data analysis portion of this research is in two parts, preliminary and simple analysis and model building. The preliminary analysis of survey results will be conducted most likely in SPSS 15, in order to establish very simple correlations that will be investigated more thoroughly as a part of detailed ethnographic work. The ethnographic conclusions will provide an anecdotal snapshot which the simple statistics from the survey work will complement. The model building process is an extremely complicated

exercise, likely taking months of effort after I have returned to UW. The data will first be manipulated in SAS and then exported to Eviews 5.0 for model building and testing. I have personal access to these programs so my self-guided training, to be augmented by several planned workshops and then an Econometrics class, can begin immediately.

BUDGET:

The fact that Chengdu is an educational center means that travel outside of the city will most likely be unnecessary to collect the data that I need. If travel is required it will likely only be out to the suburbs to observe a high schools. I do not anticipate travel costs relating to research to exceed a generous allotment of \$500. Outside of possible travel expenses, the only other anticipated expenses are gifts for helpful Chinese individuals; I do not anticipate that amount to exceed more than a \$100. A grand total of \$600 I expect to sufficient to cover the expenses due to research.

It's very complete and quite sophisticated. The main tasks right now, as you know, are to get me the shortened abstract and particularly to contact the SU students and get them to agree to a pre-test.

I think this can be a very significant project, and I look forward to following the progress and seeing the results.

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