# A Comparative Study on the Curriculum for Technology Teachers in Japan and Paraguay

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The present study reports the results of a comparative analysis performed on technology teacher curricula implemented in specialized institutions from Japan and Paraguay. Documentary research and interviews with key informants were selected as data collection measures and a qualitative version of the four step procedure developed by George Z. F. Bereday: (including description, interpretation, juxtaposition and comparison of research data) was applied as organizing framework. Results reveal common problems facing the training of technology teachers: the lack of specialized instructors, the broad diversity of contents, the costly infrastructure, the low rate of female students and the low status of the field as compared to other curricular areas. Contextual differences in social, historical, cultural and psychological conditions were found to influence structural features of the training; while a set of corresponding principles were identified directing formative efforts. Findings are expected to strengthen collaborative efforts to improve technology teacher preparation programs from a cross-cultural perspective.

## 1. Introduction

School activities brought together under the label of Manual Arts, Industrial Arts and more recently Technology Education have been taking on greater significance as curricular discipline over the last fifty years. Several developments have supported this stage, one of the most important being a better understanding of the way technology affects peoples' lives and helps to create sophisticated living environments (ITEA, 1996).

Within a context of accelerating technological change, educational systems around the world have recognized a compelling need for technological literacy in order to narrow down the widening gap between knowledge, capability and behavior of the average citizen and that of the experts who are shaping the technological world. As this trend forges on, there is a natural demand to adjust teacher training procedures in order to provide schools with qualified staff, able to comprehend the meaning of contemporary ideas put forth as theoretical framework for Technology Education and its practical implications for classroom experiences.

A number of teacher training patterns have emerged, reflecting unique features of the educational system, the level of education at which the training is offered, the level

at which Technology Education programs are implemented at school and the particular orientation; either stressing manual skills and/or more general thinking abilities. Japan has advanced in the establishment of a highly decentralized model, in which teacher preparation programs adopt various configurations and the role of the state is limited to the provision of a general outline, limited financial support and license regulations. On the other hand, a highly centralized structure has been a consistent mark of the Paraguayan model from its beginnings, with the Ministry of Education providing national guidelines and implementing measures to guarantee training quality across the country.

Correlating experiences of technology teacher training in Japan and Paraguay provides an opportunity to examine the kind of diversity expected in countries with remarkably different settings and shed light on the interplay of variables leading to the adoption of particular course of actions. As a discipline highly dependent on technological production, Technology Education raises major demands to teacher preparation programs, bound to take account of the rhythm of progress and particular dynamics of the region in which it will be implemented.

## 2. Methodology

Most comparative production in the field of Education correlate educational systems or curricular elements as they are implemented in a number of countries; nevertheless, descriptions tend to lay stress upon form and few references are made to contextual aspects to account for similarities or differences that might happen to be found along the inquiries. Based on this ground, and considering the relatively small number of articles outlining technology teacher preparation programs, a qualitative approach has been chosen to carry out data collection in this study. This standpoint has the potential to capture the complex nature of environments under study and avoid reducing subjects, settings and groups to variables, keeping a holistic perspective on living conditions borne upon historical and cultural contexts. (Alvarez-Gayou, 2003)

Curricular Guidelines from one teacher training Institution in Japan and Paraguay were examined, and articles with references on historical, sociocultural and psychological configuration of the countries were revised to gather a preliminary set of data. A triangulation process was then carried out through interviews carried out with informants playing relevant roles in the training of technology teachers within each country.

One of the main concerns in this project was the adoption of a well-grounded conceptual framework to guide the comparative process. There was an interest to accomplish a correspondence exercise in which descriptions could reach further into contextual features of Japan and Paraguay, thus extending beyond mere details of aspects observed in the systems as separate organizations. The comparative process was based on the method proposed by George Z. F. Bereday (Bereday, 1964), which in its basic form contains four steps:

a) **Description**: the first stage of comparative work requires a systematic gathering of data about the training of technology teacher in countries to be compared.

b) **Interpretation**: collected data are interpreted within the context of several social sciences. For this study historical, social, economical and psychological aspects were considered.
c) **Juxtaposition**: principles and criteria for the comparison process are established. A reasonable hypothesis needs to be generated for the last step of the process.
d) **Comparison**: countries under study are examined simultaneously and the validity of the proposed hypothesis is tested.

## 3. Description of Technology Teacher Preparation Programs

### 3.1. Technology Teacher Training in Japan[8)]

The training of Technology Teachers in Japan is carried out at post-secondary level in national or private universities, over a period of 4 years. The basic requirement for Technology Teachers is a Bachelor degree, however; the Educational Personnel Certification Law issued in 1998, prescribes a number of 20 credits for a first grade license and 10 credits for a second grade license. Students usually earn credits by taking a set of different compulsory and elective lectures they have available either at departments of engineering and agriculture or in teachers' colleges.

There are three types of license for technology teachers; the first, second and special grade. The first grade license requires 20 credits in the major course. The second license requires 10 credits. The special license requires 6 credits taken at a graduate school. As provided by law, teachers must hold a certificate issued by a prefectural board of education. These certificates are divided into three categories: a regular certificate, an advanced class certificate and a temporary certificate for assistant teachers.

As a result of the rather homogeneous character shown by the educational system, subjects required for a Bachelor Degree in most universities are very similar. Table 1 shows an example of the set of subjects required to become secondary school teachers in Japan.

The set of subjects grouped under the name "Course Major Subjects" are intended to provide training in specialized fields related to Industrial Arts. There are 6 fields of study and 18 compulsory subjects comprising 20 credits and 24 elective subjects are offered to provide additional 31 credits. On the other hand, the set of subjects clustered as "Course Educational Subject" deal with methodologies for Technology Education and include four compulsory subjects. Table 2 presents more details on the curriculum offered at Aichi University of Education for Technology Teacher training.

Among the major issues currently facing the training of technology teachers in Japan are:

a) Teachers' colleges don't have specialized instructors in all topics required for Industrial Arts in Junior High School. As a result, part-time teachers or non specialized instructors are in charge.
b) Students who wish to become technology teachers need to deal with a variety of

technological contents and develop teaching skills. As a consequence their training ends up broad and shallow.

c) Students graduating from a technical university usually developed a strong specialized background but their teaching training is barely enough to cover the needs of school practice

d) Students graduating from pedagogical universities or colleges have a strong educational background but their technical training on specific contents is usually insufficient.

e) The number of female technology teachers is still low reaching less than one percent.

f) Once teachers are employed, they are granted permanent position. However, since professional development is not compulsory, improving teaching performance is uncertain.

g) High School graduates wishing to become teachers are not attracted to Technology Education because of the relatively few amount of hours

It is worth mentioning the role played by national professional organizations such as the Japanese Society of Technology Education, which holds workshops and conferences in different prefectures every year. These organizations make efforts to consolidate the field of Technology Education as curricular subject, promoting a variety of publications and closer relationship with the MEXT (Ministry of Education, Culture, Sports, Science and Technology) for policy formulation and curricular design.

**Table 1. Requirements to teach at Japanese Secondary Schools** (Miyakawa, 2006).

| **Subjects** | | **Credits** |
|---|---|---|
| **General Subjects** | | **29** |
| Liberal Arts | Constitution of Japan | 2 |
| | Basic Subjects | 6 |
| | Theme Subjects | 8 |
| Computer Literacy | | 2 |
| Foreign Language | First Foreign Language | 4 |
| | Second Foreign Language | 2 |
| | English Communication | 2 |
| Health and Physical Education | | 3 |
| **Subjects** | | **Credits** |
| **Professional Subjects** | | **83** |
| Introductory Studies for Professional Education | | 2 |
| Common Major Subject | | 2 |
| Course Study Subject | | 2 |
| Course Major Subject | | 34 |
| Course Educational Subject | | 8 |
| Educational Subject | | 25 |
| Subject related to the course or Teaching Profession | | 4 |
| Graduation Thesis Research | | 6 |
| **Independent Subject** | | **16** |
| **Total** | | **128** |

**Table 2. Subjects for Technology Teacher Training at Aichi University of Education** (Miyakawa, 2006).

| Subject Area | Title (Compulsory) | Credits | Title (Elective) | Credits |
|---|---|---|---|---|
| Woodworking | Woodworking Method | 1 | Woodworking 1 | 1 |
| | Woodworking Practical Exercise 1 | 1 | Woodworking 2 | 2 |
| | Woodworking Practical Exercise 2 | 1 | Woodworking practical exercise 3 | 1 |
| | Drawing 1 | 1 | Woodworking Experiment | 1 |
| | | | Drawing 2 | 1 |
| Metalworking | Metalworking Method 1 | 1 | Metalworking Method 2 | 1 |
| | Metalworking Practical Exercise 1 | 1 | Metalworking Method 3 | 1 |
| | Metalworking Practical Exercise 2 | 1 | Metalworking Practical Exercise 3 | 1 |
| | – | | Metalworking method 4 | 1 |
| | – | | Metalworking Experiment | 1 |
| Machines | Material Dynamics | 1 | Mechanical Engineering | 2 |
| | Mechanical Dynamics | 1 | Mechanics | 1 |
| | Mechanical Experiment | 1 | Thermal Dynamics | 2 |
| Electricity | Electricity 1 | 1 | Electronics 1 | 2 |
| | Electricity 2 | 1 | Electronics 2 | 2 |
| | Electrical Practical Exercise | 1 | Electricity 3 | 1 |
| Cultivation | Cultivation | 2 | Plant Cultivation 1 | 1 |
| | Cultivation Practical Exercise 1 | 1 | Plant Cultivation 2 | 1 |
| | – | | Agriculture | 2 |
| | – | | Cultivation Practical Exercise 2 | 1 |
| Information Technology | Information 1 | 2 | Software 1 | 1 |
| | Programming 1 | 1 | Software 2 | 1 |
| | Basic Information Technology | 1 | Information 2 | 2 |
| | – | | Programming 2 | 1 |
| Technology | Industrial Arts 1 | 2 | – | |
| | Industrial Arts 2 | 2 | – | |
| | Industrial Arts 3 | 2 | – | |
| | Industrial Arts 4 | 2 | – | |

### 3.2. Technology Teacher Training in Paraguay

Since a major curricular reform took place in Paraguay in 1994, school activities traditionally classified as manual or industrial arts have undergone major transformations and the training of teachers has adopted different patterns, seeking to bring about professionals better qualified to deal with the significant paradigm shift produced in the field currently known as Technology Education

The introduction of a new school subject called "Trabajo y Tecnología" (Work and Technology) from the 4$^{th}$ to the 9$^{th}$ Grade made evident the lack of teachers with a basic

understanding of the vision proposed by the educational reform. Teachers from a variety of fields such as Industrial Arts, Plastic Arts, Home Economics, Technical Drawing, Manual Arts and Workshop were therefore recruited for an intensive training program, on completion of which new positions were assigned as "Work and Technology" specialists. From that time onwards, technology teachers have been trained in 2 year long graduate programs targeting in-service elementary school teachers. Just recently, training at the pre-service level has begun to be offered by a number of teacher training centers over a three year period, covering around 5000 academic hours.

There is still no proper licensing system working in Paraguay. Upon graduation, students receive a certification which allows them to apply for openings available at public or private schools. Teaching positions are granted through a selection process that includes professional and psychological assessment of candidates. Subjects required to become technology teacher in Paraguay are described in Table 3. The curricular design adopted an integrated structure of five domains regarded as essential for the praxis of a future technology teacher. Each of these domains relates to one particular aspect of the professional qualification needed for teaching practice, as described below:

**Table 3. Subjects/Time Allocation for Technology Teacher Training in Paraguay** (ISE, 2006).

| Year | Humanistic and Social Knowledge | Pedagogical Knowledge | Instrumental Knowledge | Specific Knowledge | Practical Training | Time |
|---|---|---|---|---|---|---|
| 1st | Biological Foundations of Education<br>Educational Psychology<br>Philosophy of Education<br>Career Guidance<br>Sociology of Education | Pedagogy I<br>Didactics I | Mathematics<br>Spanish I<br>Guaraní I<br>Information Technology I | Technological Design I<br>Business Management I<br>Applied Technology I<br>Technological Settings I<br>Industrial Security and Hygiene I | Project "Exploring the Educational Reality" | 1620 |
| 2nd | – | Pedagogy II<br>Didactics II<br>Class Management | Spanish II<br>Guaraní II<br>Information Technology II | Technological Design II<br>Business Management II<br>Applied Technology II<br>Technological Settings II | Pedagogical Project I | 1620 |
| 3rd | – | Didactics III<br>Educational and Work Legislation | Spanish III<br>Information Technology III | Technological Design III<br>Business Management III<br>Applied Technology III<br>Technological Settings III | Pedagogical Project II | 1620 |
| **Total Time** | | | | | | **4932** |

**Obs.**: The time is expressed in academic units of 45 minutes.

a) **Humanistic Knowledge**: seeks to provide fundamental humanistic and social knowledge on Biology, Psychology, Philosophy, and Sociology that are essential for teaching practice.
b) **Pedagogical Knowledge**: deals with fundamental knowledge and skills on Pedagogy, Didactics, Class Management and introduce students to legal issues on education.
c) **Instrumental Knowledge**: it intends to strengthen language and mathematic skills students have worked on in High School. At the same works on the development of computer operation skills and its didactical use.
d) **Specific Knowledge**: covers topics related to Technology as a general concept and the operation of technological processes and products and analyzes their impact in a variety of human environments.
e) **Practical Training**: aims to develop practical skills for teaching work through a variety of experiences carried out in school settings.

The main issues currently facing technology teacher training in Paraguay are indicated to be as follows:

a) There are still few institutions offering pre-service training for technology teachers.
b) The experience of training technology teachers at graduate level has not been satisfactory due to the lack of time available to develop practical skills in Technology.
c) Facilities in teacher training institutions are not prepared for practical training in fields such as woodworking, metalworking, machines, etc.
d) Teacher educators are still not familiar with contemporary concepts promoting a major paradigm shift in Technology Education. As a result, in some cases students are still dealing with issues based on industrial/manual arts principles.
e) The number of female students pursuing a career as technology teachers is very small.
f) There are very few opportunities for in-service training in Technology Education and the quality of them is regarded by teachers as usually poor.
g) Since topics formerly part of Industrial Arts and Home Economics were brought together as units to be covered in a new subject, future teachers are challenged by the amount and diversity of contents they need to be skilled at to do an effective job.

## 4. Context of Interpretation for Research Data

### 4.1. The Japanese Context

i) **Historical Aspects: In 1997**, the Curriculum Council revised the National Curriculum Standards for all levels of formal schooling (Kawakami, 2005). The Council analyzed how to create a system where children can develop a balanced personality and become productive members in the society of the new millennium. The Council of Teacher Education issued a "First Recommendation to Improve Teacher Training Programs," establishing changes at three levels: pre-service training programs at Universities, appointment of teachers by Prefectural Boards of Education and in-service training of teachers at schools, municipalities, prefectures and universities.
In 1998, part of the Educational Personnel Certification Law was revised and modified, authorizing each university to organize their own curriculum based on

social needs established in a general document.

ii) **Social Aspects**: Japan has always been characterized by a rather homogeneous ethnic group. Cultural traditions are deeply embedded into social interactions and the educational system has made efforts over the years to promote the development of a strong national character. Japanese teachers hold a respectable position in society and teaching has long been a comparatively attractive profession (Shimara, 1991). Moreover, competition for available positions at schools has grown because of the higher salaries assigned to teaching positions as compared to other public employees. On the other hand, social expectation regarding teachers' job is very high and they are often criticized and held responsible for their inability to deal with problems at school and in wider social contexts. In the latest reform, educational authorities have made efforts to increase awareness of the primary role played by family, community and school in the education of children. Nevertheless, it will take time for these ideas to gain wider acceptance in everyday school life and teachers will still be held accountable for developing students' personalities.

iii) **Economical aspects**: Japan is a major economic global power with free-market economy strongly relying upon the development of qualified human resources. Several factors have joined forces to produce this growth, among them government-industry cooperation, a strong work ethic, mastery of high technology, and a comparatively small defense allocation. The educational system has been assigned the strategic task of preparing the future generations who will sustain and improve the rates of economic growth in this era of accelerated technological progress. Because of the fundamental role played by technology in Japanese industries, there is a growing recognition of the need to reinforce technology education programs at schools and update the training of technology teachers.

iv) **Psychological Aspects**: the Japanese individual has particular desirable personality that teachers are expected to work on at school. A typical Japanese is expected to exhibit a number of qualities and traits that will guarantee him/her active and productive participation in their future social contexts. Worth to mention among these features are the capacity to be obedient and compliant with parents or superiors, the strength to endure pain and deprivation with patience, the ability to persist, to hang on, to do one's best, the acceptance of the position and set of duties assigned to him/her by society, etc. (Kodansha, 1996).

### 4.2. The Paraguayan Context

i) **Historical Aspects**: Following a coup d'état staged in 1989 to overthrow a 35 year dictatorship in Paraguay, radical measures were taken to lead the country towards democracy. One of the most important resolutions had to do with a thorough revision of the educational system according to the envisioned future of the Paraguayan citizen. As a consequence, a Law of Education was passed and educational goals, curricula and organization were redefined and implemented since 1994. Although manual activities were firmly established in schools across the country since the 1920's, they had experienced significant transformations over the years regarding meaning, purpose and type of practical work that would be

beneficial for children. Following the last curricular revision in 1972, manual arts were introduced in the first school year and extended throughout the six years of elementary education. Above this level, a different subject closely related to Technology Education named "Talleres" (Workshops) was adopted in Junior High School, covering topics such as Technical Drawing, Industrial Arts, Home Economics, etc. The variety of contents posed a major challenge in terms of teacher preparation, and different training programs were offered to meet the needs raised by the compulsory nature of this subject. However, when the structure of the system was modified to extend elementary school from 6 to 9 years and introduce "Work and Technology" as curricular subject from 4$^{th}$ to 9$^{th}$ Grade, a great diversity of professionals skilled at a variety of contents were available as prospective Technology Teachers.

ii) **Social Aspects**: Paraguay is a country of major social contrasts. Despite the increased levels of freedom experienced in the post-dictatorship era, clear differences persist between urban and rural areas (Vera, 1994). Ethnically, culturally, and socially, Paraguay is said to be one of the most homogeneous populations in Latin America. As a bilingual country, with around 90% of the population speaking the native Guaraní language and another 75% European Spanish, teachers face major challenges at school to prepare future citizens that will be able to communicate in both languages fluently. Social hierarchies make distinctions between town and country dweller, employer and laborer, and mental and manual worker, but there is a fairly high degree of mobility between classes, and even the poorest peasant displays a strong degree of personal pride. Social status of teachers have changed over the years and especially in larger cities teaching work is today regarded as a second class occupation with corresponding low levels of income as compared to other professions with higher social value (i.e. engineer, lawyer, medical doctor, etc.)

iii) **Economic Aspects**: Paraguay has a market economy marked by a large informal sector that features both re-export of imported consumer goods to neighboring countries as well as the activities of thousands of microenterprises and urban street vendors. The formal sector is largely oriented toward services. A large percentage of the population derives their living from agricultural activity, often on a subsistence basis. Economic sectors with more activity tend to be reflected in the orientation given to Technology Teacher preparation programs. In fact, practical training is usually focused on primary and tertiary sectors (agriculture and businesses) while activities in the secondary sector (industrial production) tends to be dealt with more theoretically. An exception can be found in small-scale food production, which usually is covered more in depth and related to microenterprise projects.

iv) **Psychological aspects**: the educational reform brought about a new vision of the Paraguayan citizen for the new millennium. Curricular guidelines indicate the need to educate children that show understanding and solidarity in their relationships with others, sensitivity to the natural environment and awareness of God, a creative spirit to transform society and positive attitudes towards productive work (MEC, 1997). Another major concern for the educational sector is the bicultural character of the country with the native heritage of the "Guarani" people (the primitive

inhabitants of the country) and the European influence brought by the Spanish people during the colony.

## 5. Juxtaposition

Teacher preparation in Japan is characterized by a decentralized and flexible constitution in which several paths are available to prepare teaching staff for Technology Education. On the other hand, training of Technology teachers in Paraguay is restricted to a handful of institutions authorized and supervised by the Ministry of Education, rendering a highly centralized configuration.

Japanese schools have introduced a subject named Gijutsu/Kateika (Technology/ Homemaking Education) to address technological issues. The subject adopts a particularly complex configuration, with two different types of knowledge (i.e. Manufacturing Technology and Homemaking Education) organized as essentially independent curricular fields. This hybrid nature has strongly affected teacher preparation, demanding two different professionals (i.e. Technology teachers and Homemaking teachers) trained in independent departments at universities and colleges of Education. Paraguay has integrated both Technology and Home Economics into a single notion of "technological behavior" addressed in a subject named "Trabajo y Tecnología" (Work and Technology). This conceptual feature has influenced preparation of future teachers, currently trained as both Technology and Home Economics specialists at unified departments in specialized centers across the country.

Provision of teaching licenses in Japan is based upon a system of academic credits prescribed by law. Training centers are given autonomy to develop their own curricula and make decisions regarding the extent to which particular topics will be emphasized. As a result, the same number of credits may be assigned for less allocated time in specific subject areas, producing technology teachers with a wide range of qualifications in a variety of contents. Moreover, since the law prescribes six major subject areas, without specific provisions on subjects to be offered, curricula at different universities tend to reflect professional background and experience of faculty members in different technological fields.

Paraguay has not yet established a formal licensing procedure and teacher accreditation is highly dependent on the centralized structure still prevailing in the country. The Ministry of Education has conceived a strategy to control the quality of technology teacher preparation. Teacher training institutes are thereby granted certain freedom to propose their own curricula, which needs to be approved by a selected team of curriculum specialists from the General Division of Higher Education. Although this centralized structure tends to produce more uniformity from school to school, practical conditions in training centers (infrastructure, teachers, etc.) usually restrain successful implementation of theoretically well designed programs.

The Japanese system of Technology teacher preparation faces several problems, among the most critical being the extreme diversity of contents students need to be acquainted with, a broad and shallow professional preparation, gender asymmetry and

decreasing enrollment rates. In Paraguay, concerns regarding Technology teacher preparation focus on the reduced number of training centers available, lack of adequate facilities to provide practical competence, gender asymmetry and a persistent influence on teaching practices of the Manual/Industrial Arts paradigm. Based on current conditions, it is likely that future improvements on the Japanese system will emphasize wider recognition of the field, recruitment strategies for future students and an adequate balance between general/specific contents addressed in Technology Education. The Paraguayan system will most likely direct efforts towards more budget allocation to improve infrastructure, increased quantity and quality of training for faculty members and more social recognition of the field.

## 6. Comparison

Contextual variables such as history, culture, social conventions and psychological features of Japanese and Paraguayan people are reflected in technology teacher preparation programs. Particularly significant in the Japanese historical development was the framework for educational reforms presented by the occupation authorities after the II World War. The history or Paraguayan reforms is more recent, however, educational practices observed in the field match those observed in Japan to a significant extent. Social perceptions of teaching work plays a crucial role in both countries, however in opposite directions, since teachers in Japan enjoy a considerable higher status than their respective colleagues in Paraguay. Current features of Technology teacher training can be clustered into several units to facilitate the comparative analysis, as shown in Table 4.

**Table 4. Comparative Units of Technology Teacher Training in Japan and Paraguay.**

| Comparative Unit | Japan | Paraguay |
|---|---|---|
| **Credential** | License | Certification |
| **Structural Feature** | Decentralized, training offered in universities | Centralized, training offered in teacher training centers |
| **Curriculum** | Flexible, organized in semesters and credit-based | Fixed, organized in school years |
| **Subjects** | 31% Major-related, 33% Education-related 23% General, 13% Elective | 41% Major-related, 36% Education-related, 23% General. No electives. |
| **Requirement** | 128 Credits | 3,288 Hours |
| **Teaching practice** | 4 to 6 weeks | 1,152 Hours |
| **Current issues** | Contents Diversity, low enrollment rates, gender asymmetry. | Contents diversity, poor infrastructure, few training centers, gender asymmetry. |
| **Directions for the near future** | More recognition of the field, better recruitment strategies, balance of general/specific contents. | More budget allocation, decentralization, more qualified faculty members, social recognition of the field. |

Procedures to obtain teaching credentials are different in Japan and Paraguay; while Japanese students are granted licenses after approving official tests given by prefectural authorities; Paraguayan students are certified as teachers after completing their training period at any of the centers authorized by the Ministry of Education. This contrast is related to the different role played by the state in teacher preparation; while the licensing system was partly introduced in Japan to overcome dispersion in teacher qualification, in Paraguay, supervision of training centers carried out by the Ministry of Education seems to render the kind of system operating in Japan unnecessary.

Japan and Paraguay seem to be located in opposite extremes along the continuum centralized/decentralized administration and open/closed curricular development. Differences can also be observed in curricular organization and positions regarding theoretical/practical training. On the other hand, high levels of correspondence can be found regarding the kind and amount of knowledge future teachers are required to be acquainted with for effective professional practice. As shown in Table 4, Teacher Training Curricula developed in both countries include similar proportions of general subjects, technology-related subjects and education-related subjects.

Curricular contents for Technology teacher preparation in Japan are mainly associated with industrial activity and development, while in Paraguay, topics on productive activities in primary, secondary or tertiary sectors can be found as part of Technology teacher training programs. Time devoted to the training differs to a certain degree, extending in Japan over a total of 4 years in a minimum of 2,880 hours of actual lectures (1 credit = 22.5 hours/semester). In Paraguay training covers 3,290 hours within a period of 3 years. There is also an important difference observed in students' teaching practice at school. As a matter of fact, while in Paraguay, future teachers are systematically introduced to school life from the first year of training, actual school experiences are usually carried out in Japan during the last year of training.

Japan and Paraguay are facing a number of common problems regarding the training of technology teachers, among the most important being: the lack of specialized instructors, the broad diversity of technological contents that need to be covered during the training of Technology teachers, the costly infrastructure required to train qualified technology teachers, the low rate of female students enrolling in the field and the low status of the field as compared to other teaching areas.

## 7. Conclusions

Technology teacher training in Japan and Paraguay has experienced substantial transformations since their institution in the early decades of the 20$^{th}$ century, reflecting the ephemeral nature of the course taken by school curricula regarding children's manual and productive activities at school. Local configurations produced by historical, social and cultural conditions seem to have affected formal features of the system, particularly visible in organizational aspects and implementation strategies for teacher preparation programs. Nevertheless, fundamental principles stated in recent reform documents reveal both countries addressing teacher preparation based upon essentially

corresponding rationales.

The centralized system in Paraguay promotes unified training, regardless of particular location or conditions of training centers. At the same time, mechanisms to ensure quality training and accountability of training results seem easier to implement. On the other hand, centralization brings about less adaptable systems for local needs, while teachers seem to grow less creative for educational reforms and more dependent on guidelines provided by central authorities.

Decentralization in Japan confers universities more decision power concerning curricular management and organization; however, there is a serious risk to produce very different qualifications of technology teachers when no proper structures are available to guarantee standardized training.

The lack of a solid conceptual framework poses a major obstacle to consolidate Technology teacher preparation programs and renders the field less attractive for prospective students. Both countries will therefore need to increase research efforts at all educational levels to produce objective evidence of the educational benefits concerning technology-related activities at school. Prominence of the teaching job in Japan will be an important asset in promoting qualitative and quantitative leaps in the short term, while the situation will likely be more complex in Paraguay, where consolidation of technology teacher training relies upon a significant improvement of the unfavorable social attitude towards educators.

This cross-cultural exploration of Technology teacher training revealed two systems of great cultural and geographical distance that, at different paces, are clearly evolving in the same direction, thus allowing the presumption that Japan and Paraguay will continue strengthening a decentralized technology teacher training model, placing ever more emphasis on technological processes and less on specific technological contents, in an effort to produce teachers that will effectively cope with current trends in Technology Education.

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