BRIDGING SCALES AND EPISTEMOLOGIES: LINKING LOCAL KNOWLEDGE WITH GLOBAL SCIENCE IN MULTI-SCALE ASSESSMENTS.

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BLOCK 4: Concurrent Sessions

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The authors have been working and publishing together in the fields of Indigenous Knowledge Systems (IKS) and PAUS since 2000.

TITLE OF PAPER:

LINKING INDIGENOUS KNOWLEDGE WITH ATTITUDES TOWARDS SCIENCE AMONG ARTISANS IN INDIA AND SOUTH AFRICA – A COLLABORATIVE CROSS-CULTURAL PROJECT

ABSTRACT:

In this paper, we discuss a collaborative research project between India and South Africa that involves the documentation, study and understanding of the extent to which indigenous knowledge systems (IKS) and modern technologies are utilized in the traditional manufacturing processes of artisans in both countries. The focus of the project is on redefining the characteristics of *'knowing'* (of knowledge) as not just a mere contemplative gaze, but also as a practical activity. By focusing on artisans, we place the question of knowledge in a material and practical context. We weave together indigenous knowledge systems of the production of artifacts with the artisans' understanding of science and technological processes. This allows us to develop interventions that capitalize on existing skills, practices and social relationships rather than undermining them, which contributes to their sustainability. In our presentation, we will share the pitfalls and successes of this multidisciplinary, cross-cultural international research project with the help of a visual, interactive slide presentation. We will begin by discussing the theoretical issues underlying knowledge production and utilization, particularly in the context of uneven development. We then turn to our research methodology, which assessed the artisans understanding of science as well as their socio-economic circumstances. We will share the processes of developing the questionnaire, conducting the field surveys in both countries, as well as the subsequent publishing of the research findings. These experiences will be of value to other researchers embarking on cross-cultural and cross-disciplinary research projects.

INTRODUCTION

The gap between the socio-economic conditions of developed countries and the developing world is currently recognised as a problematic aspect for researchers, especially for those working from within the developing world. As a result, extensive discourse on research related aspects such as research ethics, philosophical concerns and appropriate research methodologies are taking place within the social, political and cultural spheres of developing countries. Academic concepts and definitions of culture, identity, colonialisation as well as politics and power structures are being re-defined and adapted to comply with the requirements of such research in the global dialogue.

Africa is partner to this discourse and South Africa (in specific) is committed to conducting research in an increasingly active, integrated and creative manner. In a developing continent the focus is on redefining the characteristics of *'knowing'* (of knowledge) as not just the mere contemplative gaze of researchers, but also as a practical activity. There is a general consensus that *'to know a human fact, psychological or social, no longer means to investigate it with the aid of statistics and graphs, but to live it'* (Sengor.1965:71). With the recent recognition of the intellectual value of indigenous knowledge systems (IKS) for research practices there is acknowledgement that one

cannot separate the *'knower'* from the *'known'*. It furthermore implies that one cannot make a distinction between two kinds of reality, one purely mental, the other merely material. A paradigm shift in the way we regard research in Africa could provide the necessary intellectual tools for expressing and exploring the insights of traditional African thinking in a systematic way. This could well be achieved through the use of science communication and its progeny; the public attitude towards and understanding of science (PAUS). *"In our contemporary world, where sustainable development, a great aspect of which is concerned with the enhancement of the material well-being of people, depends on the intelligent and efficient exploitation of the resources of nature - an exploration that can be effected only through science and its progeny, technology - the need to acquire the cultivation of the appropriate scientific attitudes is an imperative"* (Eze.1997: 31).

The investigation of relevant concerns and the design of appropriate tools for probing these issues is the primary aim of this cross-cultural project. This endeavor is reflected in current publications and debates. *"Examining the viability of rural manufacturing, the existing structures of rural manufacturing practice reflect the prevailing conditions under which production takes place and therefore contain features that are fundamentally appropriate to their context. An approach to intervention is therefore proposed which capitalises on existing skills, practices and social relationships, and it is shown that by working with existing structures and skills rather than undermining them, the sustainability of the enterprises which are developed, is greatly enhanced"* (Poston.1994:xi).

This research project between researchers in India and South Africa involves the documentation, study and understanding of the extent in which indigenous knowledge systems (IKS) are utilised in the traditional manufacturing processes of practicing artisans/crafts persons in both countries. The understanding of modern Science and Technology (S&T) in the production of artifacts needs to be established and linked with the traditional knowledge and S&T processes used daily in indigenous production processes. Science communication developed PAUS as its important fledgling to accommodate this process.

THE PROJECT

Developing countries currently grapples with the need to successfully implement sustainable knowledge-based development requirements. These needs, implementations and requirements are all equally complex. There is, for instance, a need to address the global social requirements for development, the importance of contributing in a meaning full way to global dialogue and the growing demands of the global industry. All these are striving to advance communities in both the developed and the developing world. At the core of research in developing countries there is a growing recognition regarding the importance of participation in these global needs. In support of this there is growing importance of the question on how to support innovation and sustainable development within the rural communities. It is therefore of no surprise that our developing countries are currently grappling with new research requirements, conditions and incentives. These consequential new criteria demand research empathy. It is also instrumental in the

introduction of new fields of research such as indigenous knowledge systems (IKS) and the public attitude towards and understanding of science (PAUS).

Both these fields of research currently embrace changed perceptions about science and do not see science as a reality separate from daily human existence any more. The terminology used in IKS and PAUS may be new, but the concepts are quite old. Similar debates under different terms and concepts were conducted in the past. John Dewey, for instance, published a paper in 1938 titled *'Common sense and scientific inquiry'* where he argued that *' in a cultural environment, physical conditions are modified by the complex of customs, traditions, occupations, interests and purposes which envelops them* '(Dewey in Appleby, 1996:267). He, more importantly, discussed the awareness that obtaining knowledge in order to survive and cope with daily life was seen as *common sense* and was instrumental in the structuring of cultural groups within their own specific traditions.

Today this environmental involvement, based on the *common sense* behavioral adjustment of people, constitutes IKS. IKS is thereby seen as linked with culture whereby *'Culture can be loosely summarized as the complex of values, customs, beliefs and practices which constitute the way of life of a specific group'* (Eagleton, 2000:34). In the science world, in a traditional sense, there was no necessity during scientific inquiry to have direct and immediate interaction with the community and/or their environment and life procedures. The western based theorising and experimental part of science was seen as important and could be conducted in isolation in laboratories and libraries. When in need of specimens, these were collected in the field and brought to the labs and museums of Europe to be studied at leasure. Today these previously neglected communities are seen as the custodians of a wealth of knowledge in need of documentation. To broker this process science communication developed as an important new field of research to bridge the gap between the developing and developed worlds.

This paper discusses the results of a cross-cultural collaborative project under these two fields of research. The first field involves the complexity of IKS seen as being closely related to culture. Culture was historically seen as a value concept (Weber, 1904; Eagleton, 2000) and has since become the topic of endless intellectual debates. Deliberation on how to define and assess issues related to culture is playing a progressively more important role in academic circles. IKS form a crucial part of this debate, especially in developing countries.

As IKS contain and protect aspects of identity, personal and inter-personal relationships, the study of IKS becomes culturally significant because of its relative importance in connecting with individual needs and value perceptions in a specific society. We need to formulate theories about cultural structures, including IKS, to assist in analysing reality and to prevent it from being seen as a *'chaos of existential judgments'* (Weber, 1904:242 in Appleby). We therefore identify causal laws and definitions as a means to assist in cultural studies. This, in turn, facilitates and renders possible the fundamental interpretation of the cultural activities of a community. It, at the same time, links these cultural activities to the concrete causes of the components of the phenomenon of individuality which is culturally significant.

The second area of investigation in this project is concerned with the new requirements for science research in developing countries (Sardar, 2002; Hountondji, 1997; Smith, 1999). Science today is required to be more accountable, more communicative and more dialogical. Part of this new vision for science is the requirement that *'science should comprehend the fact that science is a product of culture, or cultures'* (Hoppers, 2002:4). In the UNESCO *'Declaration on science and the science agenda framework'* adopted in Budapest, Hungary (1999), a drastic change in attitude, methods and approach in the scientific field was called for. The sciences must be put to work for sustainable development, and to the solving of problems in such development, especially in the social and human dimension. Sciences must transform and *'must become inclusive of women and other forms of knowledge in terms of its culture of administration and operation'* (Hopper, 2002:4).

The project: Indigenous knowledge systems and technologies among artisans in India and South Africa: a collaborative cross-cultural project.

This study forged links between the two relatively new fields of research – IKS and PAUS. It looked at a reciprocal relationship that exists between the indigenous technologies of artisans in rural communities, IKS and PAUS. It concentrated on the way scientific methodology could be applied to measure IKS and PAUS. Data was collected on how local communities' understanding of science impact on indigenous technology and the role of education (both formal and informal) in this regard.

The project consisted of a research team comprising of members from the Faculty of Art, Design and Architecture (FADA) at the Technikon Witwatersrand, South Africa [1] and scientists from the National Institute of Science, Technology and Development Studies (NISTADS), CSIR, India. The South African art and design researchers were mainly concerned with IKS and the India social science researchers were specialising in research on the public attitude and understanding of science (PAUS). A series of workshops were held [2] and, by focusing on the development of an appropriate methodology, a questionnaire was developed to be used by the teams in both India and South Africa. Because of the potentially unwieldy scope of such research it was decided to focus the research on the knowledge systems and indigenous technologies of potters.

The project developed an appropriate research methodology to assist with the assessment of the PAUS of traditional artisans. A flexible questionnaire was developed through a number of workshops (Raza & du Plessis, 2002) that functions on two levels and evaluates:

- socio-economical needs, perceptions and circumstances of the artisans.
- traditional scientific knowledge used by these artisans.

[1] The team included members from the Arts Faculty at the Technikon Pretoria where the South African team leader was previously employed. The position of Senior Research Fellow at FADA was taken up in 2002 where the project is being developed further.

[2] The papers delivered at these workshops were published as a book : Raza, G. & du Plessis, H. 2002. *Science, craft and knowledge*. Pretoria. Protea Boekhuis.

The introduction of this methodology to graduate research students assisted in the academic process of breaking down barriers between the *'two cultures'* referred to by C. P. Snow as two cultures consisting of the humanities and the sciences, that, he says, never speak to each other (Snow, 1959).

The aim of this study was:

- to promote the concept of active field surveys as a valuable part of gaining insight into indigenous practices.
- to address the issue that the pace of acceptance of S&T in a society is inhibited by the inability of researchers to understand cultural differences.
- to measure the impact of the level of formal education influential in a community by means of a model developed for this purpose.

In India as well as in South Africa there a knowledge base exist amongst artisans, (potters in this case) still traditionally engaged in their occupations. This knowledge has been transmitted through generations of artisans by means of their oral traditions, oral histories and the practice of their traditional technologies. The take-over of modern institutions as custodians of knowledge based on western science and technology has left these communities isolated, largely due to their marginal role in the market economy. The realization that these artisan based knowledge may have greater ecological and economic sustainability has now led to a re-evaluation of their contribution to research and thus the need for the documentation of these knowledge bases. To do so is not without its problems. Correct methods, attitudes and approaches are called for (Hountondji, 1997; Smith, 1999; Eze, 1997).

The research team members, coming from such diverse backgrounds, did a literature survey on all the current debates and arguments regarding IKS, PAUS and methodologies such as participatory action research (PAR). It was decided to concentrate on qualitative research methods. A questionnaire was developed that is sympathetic to current academic demands to provide a platform for constructive appropriate research. The questionnaire was designed in two sections. The first part of the questionnaire provided data on the socio-economical needs and requirements of the community. Indigenous technological knowledge can be collected as part of the second section of the questionnaire and can be adapted according to the craft being surveyed. (Raza & du Plessis, 2002) and included variants that look at not just the indigenous knowledge, but also the potters use and understanding of science.

Surveys were done in both countries and notes were compared about the similarities and differences between two groups of potters in these different countries comprising of dissimilar cultures. Though the geographical location and available materials differ between the groups of potters and is used differently by the different cultures, the basic knowledge regarding scientific facts applied during the manufacturing process of the pots are the same. Based on previous studies at NISTADS it became clear that there is an intermediary activity that influence the people's knowledge base that operates between IKS and PAUS. This is identified as the level of formal education of the artisan and its

resultant impact on the level of understanding of scientific facts. Here the past research done by the NISTADS team became invaluable[3].

A number of surveys were done by the NISTADS team from 1989 onwards that probed issues like health and hygiene, agriculture, geography and climate and astronomy and cosmology (Raza, G & Singh, S; 1996). During 1992 the team investigated the communication network prevalent among artisans who, in India, are engaged in electric motor winding, auto repair and mechanical typewriter repair workshops. The survey compared these workshops to the formal school system as *legitimate centers of learning*. It became evident during the course of their investigation that, without preliminary knowledge of prevailing cultural practices, prevalent social and technological concerns and the impact of market forces on the livelihood of the artisans, it would be almost impossible to devise a methodology for probing IKS. In 1994 during an outbreak of plague in Maharashtra and Gujarat, the team conducted a survey on the awareness, knowledge, attitude and perception of the populace on health in general and the plague in particular. This survey proved this methodology to be a valuable instrument to measure public knowledge (Raza, G. & Dutt, B. & Singh, S; 1996).

The result of these surveys has helped in establishing PAUS as a legitimate area of inquiry in India. *'The cultural world-views of various groups of people dubbed, without proper investigation, as irrational structures of thought need to be looked at critically. Within these cultural complexes of thought, rationality i.e. scientific rationality, and extra-scientific rudiments co-exist in consonance. Though the match between the two, rational and irrational sets of thought is not invulnerable, it would be naïve to expect that a common citizen would act as a specialist or a scientist while taking decisions in his daily life or would scan the entire pool of scientific knowledge before arriving at an explanation of natural phenomena or experiential episode that he encounters'* (Raza, 1996;7).

Since the inception of the IKS/PAUS project in 2000, the India and South Africa teams became progressively aware of similar research objectives within the two fields of IKS and PAUS. As the area of knowledge probed amongst the potters fits well within the traditional as well as within the modern systems of knowledge, it was possible to reflect on the communalities between traditional scientific knowledge, often expressed in a different '*language*' or '*code'*, and modern scientific terms. The one, it was found, can be measured against the other and subsist in association with the other.

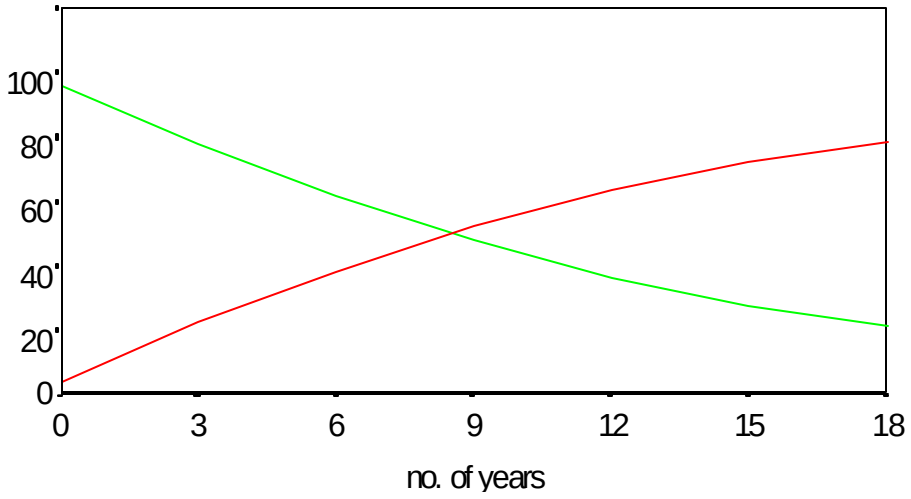
The data collected during previous surveys found that education plays a crucial role in the population's understanding of science. It was found that a longer duration of schooling led to a better understanding of science. A model previously developed by the NISTADS team to determine the cultural distance of a given scientific explanation in the daily life

[3] The complexity of human behavior makes it rather difficult to study any of its dimensions in isolation; such attempts may lead to erroneous results. The fact remains that 'schedule' or 'questionnaire' based surveys are not the best method to assess attitudes within a socio-cultural complex, while generalizing the conclusions. However, the survey-based methods do fulfill the purpose of exploring the unknown to an extent, and are indicative of the trends which form the basis to further study the desired field intensively (Raza, 1996:14).

of a common person in terms of the socialization in modern education was therefore adapted to include indigenous knowledge as part of the scale of information used by the potters[4]. As a result the knowledge scale measured spans the range from the local indigenous to the global scientific.

Brief explanation of the model:
PAUS surveys predominantly report findings based on a dichotomous scale. Therefore a dichotomous response variable is used that constitute of two categories. The first category consists of valid scientific answers and the second category consists of all invalid responses. The percentage response variable is plotted on a scale that constitutes of the years of formal schooling that the respondent has received. It is referred to as the *education variable* and is plotted on the x-axis. The y-axis represents the dichotomous percentage response variable and is represented by two curves. These curves represent the scientifically valid and scientifically invalid responses offered by the populace interviewed.

Because the response variable is dichotomous it is a given that the two curves will always intersect each other at a point where fifty percent of those who were interviewed offered valid scientific explanations or vice versa. This point we call the *index of democratization* of a concept and it indicates the education level required for the concept, idea or information to become part of the cognitive structure of fifty percent of the population being surveyed. An incremental increase in the level of education will mean that more than fifty percent of the population subscribe to a valid scientific explanation. Through this the development of a scale on which the comparative cultural distance of various scientific concepts and information from normal life (common sense/IKS) can be mapped. This is by no means a comprehensive description of the model but just an attempt to explain some of the basic features of the model.



[4] In most developing countries socialisation offered by the traditional systems and the modern system of schooling differ substantially. For this reason, in the present article, the year of schooling have been referred to as years of socialisation in modern education.

Application of the model – the way foreward:
A number of models exist in the field of PAUS. The one popular model used in Europe is the *deficit model* as identified by Prof. J Durant. This model regards the principal problem of the relationship between science and society as one of public ignorance or misunderstanding of the facts, theories or processes of science. This process initiates a one-way communication between science and a skeptical public. Durant's second model, the so-called *democratic model* of science communication, sees the public as lacking in confidence in decisions made by science and technology on its behalf. This model promotes an open dialogue between the sciences and public (Durant, 2000).

The model discussed in this paper has been developed to cover a number of practical and functional aspects and uses. The most immediate need is to further test and develop this model. The testing will be done on a project that focuses on the reciprocal relationship that exists between **traditional design and technology, IKS** and **PAUS**. Based on the ontological assumption that indigenous knowledge systems play a crucial role in the design and use of traditional artifacts, the contention will be that, during innovation of traditional products, this knowledge should be acknowledged, can be measured and should then be incorporated into the technology transfer processes.

By concentrating on the way scientific methodology could be applied to measure IKS and PAUS, it will be possible to establish how local communities' understanding of science impact on indigenous design and technology. The study will be able to identify crucial issues regarding women and technology. From within a design perspective, the focus is on **women's** indigenous knowledge systems, women's' so-called *common sense* (Dewey in Appleby, 1996:267) when using technology, women's relationship with traditional design and technology and women's input in the design process during technology transfer. Technology transfer refers to the process of implementing a technology that is developed in one social context into another social context. In this study technology transfer refers to, and predominantly concentrates on the way indigenous traditional technologies assimilate modern technologies.

On a **micro** level such a case study will provide valuable data. This case study will be done in a community situated in India where artisans still use traditional technology to produce culturally designed products, in this case the Chula. A Chula is the traditional clay cooking stove used in India and refers to the specific traditionally designed free standing pottery cooking stove as used by women in the rural areas of India. The study covers all related aspect around the manufacturing of the Chula, the diet and the cooking methods used by the community. All these factors together constitute the traditional milieu needed for this study.

On a **macro** level the study will touch on the area of meso (intermediate) policy analysis and its effect on community IKS and PAUS (Parsons, 1995). Government policy structures, national research incentives and the way such structures influence a community development program that initiate and accommodate technology transfer projects will be looked at. A National Program on Improved Chula (NPIC) was launched in India in April 1985. This incentive looked at the improvement of traditional stoves

(Chula) in the rural areas and forms part of India's Twenty Point and the Minimum Needs Programs of the Government of India under the rural development drive. The program involved rural communities, the CSIR, scientists and engineers throughout the country. Since 1985 two national surveys were done to monitor the progress of the program, the latest one in 2002. The program is currently on hold and a number of failures are being investigated. This is a perfect opportunity for testing the model developed by this research group.

A second study is currently being designed by the NISTADS team in collaboration with the India Government's Department of Science and Technology. This will involve a national study in India on the perception of communities on issues pertaining people's knowledge of science and the impact of education on such perceptions. The model will be used in this case as well.

Conclusion

Some comments regarding the results of the project is called for. The two countries (India and South Africa) both share a number of development problems. The two countries signed a bilateral agreement on research in 1998 that was followed up by a number of high level visits between the two countries. India is regarded by the South African government as a valuable partner in IKS and PAUS research. India has, since 1947, been actively dedicated to protect IKS and, where necessary, to initiate national programs to bring about innovation[5].

South Africa is in a process of transformation and is still battling with the legacy of the previous apartheid government. Research was prioritized for military development and research funds were predominantly spent on the development of weapons and the nuclear program. Local communities and their needs and knowledge were marginalized. These communities were often resettled in foreign localities, leading to a tremendous loss of local traditional knowledge and practices as such knowledge is often located within geographical areas. South Africans were cut off from the rest of the African continent and could not obtained visas to visit these other countries. There existed a cultural boycott and the gap that was created in this regard was filled with enthusiasm by the USA with its Imperial agenda. South Africa is therefore in need of a role model to look beyond its own borders and to forge links with countries grappling with similar problems.

India, after Independence in 1974, made a conscious decision to keep its traditional indigenous artisan activities alive. These activities, even today, constitute a considerable market force. Most of the artisan knowledge is still situated within the master craftsman/apprentice system of learning. The scientific knowledge used in a traditional sense is often expressed in a different '*language*' that, with a basic educational/socialisation process, can be interpreted in the correct scientific codes. For example, when the artisan was asked how he knows when the temperature of the kiln is at its maximum, the (unexpected) answer is that it is indicated by the sound of the first pot cracking in the kiln. Some variants on this question included answers regarding the color observed in the firing process that gives an indication of the temperature level. In pure

[5]. Such as the National Program on Improved Chula (NPIC) launched in India in April 1985.

scientific terms that crucial moment can be measured with a thermometer and translated into the exact scientific terms.

The model developed to measure the knowledge base of the artisans, whether it is traditional or scientific, is seen as a valuable tool to assist in bridging the gap between the traditional practitioners and modern technology in development programs. The model can also serve as support to measure the level of scientific knowledge before and after formal education, impacting on curriculum design. For researchers it serves as a method to apply while collecting data. This contributes to the general corpus of knowledge regarding our indigenous knowledge systems, indigenous technologies, indigenous design knowledge and indigenous scientific knowledge systems.

The ANC as represented in the current government of South Africa expressed the wish that, for science, engineering and technology to thrive, it must be embedded in the society it serves. The popularization of science will play a crucial role in prompting socio-economic development in South Africa.

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