

# Aussie -Sino Studies

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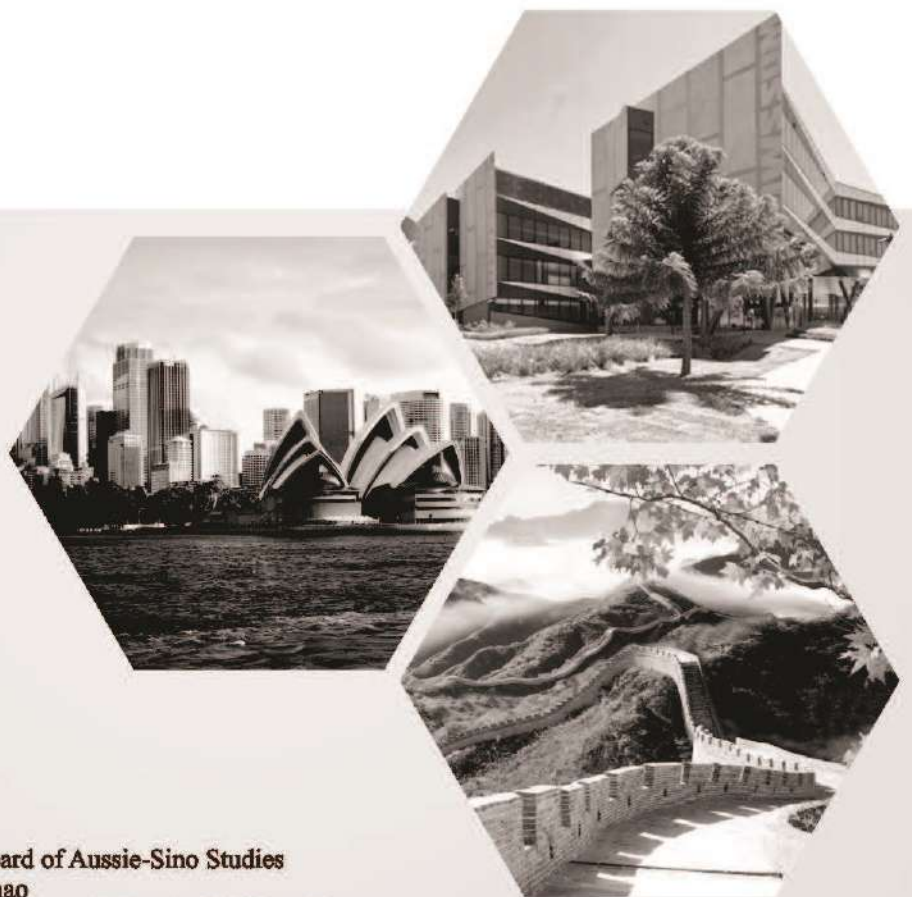
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**Editor-in-Chief:** Dr Dacheng Zhao  
**E-mail:** [assuws@163.com](mailto:assuws@163.com); [aussiesinostudies@gmail.com](mailto:aussiesinostudies@gmail.com)  
**Telephone:** 0061410630357  
**Address:** ① KG20 Kingswood Campus UWS (University of Western Sydney) Locked Bag  
1797, Penrith NSW 2751 Australia  
② 30 Casuarina CCT, Kingswood, NSW, 2747, Australia

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# The Isomorphism between the Subjects of Urban Culture Space and Higher Education Internationalization

*Liangcai Hu*

(Hunan City University, Yiyang, Hunan 413000, P.R. China)

**Abstract:** To explore the motivation for higher education internationalization from the perspective of urban culture space is fresh and novel. There is isomorphism between the subjects of urban culture space and higher education internationalization and thus the understanding of such isomorphism is the theoretical precondition for the researches on their interactivity. The subject constructs itself and its surrounding urban culture space, both spiritually and materially. On the one hand, it creates urban spiritual culture space for higher education internationalization and guarantees its historical continuity. On the other hand, it provides for it the material basis, such as, the citizens who receive internationalized higher education, the city landscape, institutions for scientific researches and art, and urban activities, which, in return, react upon the subject and urban culture space.

**Key words:** Cultural urban space, higher education internationalization, subject, isomorphism

## Introduction

There is no doubt that human beings' material and spiritual life is inseparable from space and almost all the everyday words have close relationship with it. With the expansion of the city, the development of modern geographical culture, the progress of cultural and educational theory, the researches on space theories and the subjects related to them become new sources of inspirations. However, at present, it is rather hard to give a unified definition of "space". The researches on space theories gradually experience a geography-to-culture turn since the inception of those conducted in the field of art, philosophy and geography. Since the space theory covers a broad domain, this thesis explores the isomorphism between the subjects of higher education internationalization and urban culture only from the perspective of culture space in terms of the subjects' spirituality and materiality.

## 1. The Breakthrough in the Researches on the Interactivity between Urban Culture space and Higher Education Internationalization

It gradually draws the attention of the scholars in China that higher education has a close relationship with the city's development and expansion of urban culture space. In "A Research Review on the Interrelationship between Urbanization and the Development of Higher Education", Zhu and Lin has given a panoramic view of the researches on the relationship between higher education development and urbanization, and according to them,

Urbanization and the development of higher education are mutually motivated. There are more researches on the interrelationship between urbanization and higher education development from the perspective of their interaction, relatedness and the latter's positive role in advancing the former's quality and competitiveness. However, there is no systematic theoretical model and structure concerned with the relationship between urbanization and higher education development. As for empirical researches, the main research achievements center on the numerical relationship among GDP, university enrollment rate and urbanization, while those on the relationship among its structure, quality and etc. are comparatively less.(2006, p.64)

Therefore, more discussions should pivot around the relationship between them and the reason for the formation of such relationship and their interactive model. What's more important is that China is experiencing the urbanization of the country and internationalization of the city. And the latter compared with the former has a more profound impact upon higher education. Thus, the change of urban culture has profound influence. From this perspective, a very fertile research field, namely the mutual relationship between urban culture and higher education internationalization, is neglected in most of the researches on urbanization and higher education. As been stated above, to a certain degree, city and its surrounding elements exist in the form of "space", and thus space theory can be very effective for the research on urbanization and higher education internationalization. And this article holds that the theoretical precondition for the study of this problem is the isomorphism between their subjects and the interaction between the expansion

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**Author:** Liangcai Hu, Professor, Hunan City University.

of urban culture space and higher education.

## 2. The Subject that Builds up the Urban Spiritual Culture Space: the Spiritual Culture Medium of Higher Education Internationalization

The construction of the urban spiritual culture space is not a metaphysical concept. The urban spiritual culture space has its own structure. Moreover, all social phenomena related to it (including higher education) and abstract concepts which attempts to understand such phenomena have their corresponding historical and geographical structure. It is the subject's activities of spiritual culture that accomplish the construction of this kind of historical structure. As for urban spiritual culture space, On the one hand, it (urban spiritual culture space) circulates deposits and accumulates all its products of urban spiritual in the former stages. On the other hand, it is the 'culture model' built upon the basis of the corresponding material and spiritual conditions at present" (Liu, 2007, p.19). Therefore, as a spiritual element, the urban spiritual culture space, acts as a unique humanistic element of urban spatial structure, is produced historically and develops together with human society. Its objectified materialization and immaterial manifestation have both recorded the human being's spiritual pursuit for himself. It is an advanced manifestation of the city's spatial structure and an expression of the interaction between human beings' material and spiritual activities...it is composed of dimensions like, historical space of urban traditional culture, the diversified present space of urban contemporary culture and the expanding space of the urban future culture. As a cultural form which comprehensively embodies human beings' spiritual pursuit, it...undergoes historical contemplation through the subject, and promotes the interactivity between the city's traditional and contemporary culture. In this way, the gap between the contemporary and traditional culture is bridged and historical space of traditional urban culture is produced, breaking the limitation of time and space. (Chen, 2008, p.91)

As a result, the subject constructs and integrates the urban spiritual culture space by mediating among the history, the present and the future. Furthermore, through the activities of spiritual culture, he reacts upon the city's material culture which is also a constitutive part of urban culture space. Then, the pursuit of spiritual culture becomes the primary dynamic for its construction.

The "Thirdspace" theory of the American scholar Edward W. Soja has also thoroughly expounded the subject's constructive role in spiritual culture space. According to Soja, we should not only connect the real and imagined geography but also step into the third space which exceeds the binary opposition between the subject and object. The so-called "Third space" is the dialectic between society and space in the domain

of his proposed trialectics of spatiality, historicity and sociality. The "Thirdspace" is closely related to the so-called "trialectics", which, according to Soja, is "a mode of dialectical reasoning that is more inherently spatial than the conventional temporally-defined dialectics of Hegel or Marx" (1996, p.10) Then, In contrast to dialectics, Soja identified three moments (not two), each of which is supposed to contain the others. Soja's purpose was to insist on the importance of the 'third term' in order 'to defend against any binary reductionism or tantalization'" (Gregory, 2009, p.776). Accordingly, the so-called "Thirdspace" is .A space produced by processes that exceed the forms of knowledge that divide the world into binary oppositions...it both contains binary ways of thinking about space but also exceeds them with a lived intractability to interpretative schemas that for potentially emancipator practices. (Johnston, 2000, p.753-754)

With the development of the modern city, the subject, space, society and history, to a certain degree, exist in "trialectics", which enables the "Thirdspace" theory, to become possible to a certain extent.

Thus, the roles of subject in the urban spiritual culture space can be understood from two aspects: firstly, the subject plays a positive role in its historical construction; secondly, such construction is mediated by "trialectics" or, to a certain degree in "Thirdspace". The subject of higher education, which is an important part of the spiritual culture of the city, promotes its internationalization also in these two ways in modern urban culture space.

Firstly, the subject is the mediator between modern urban spiritual culture space and higher education internationalization in terms of the mutual influence of their spiritual driving forces. Higher education internationalization happens in a certain spiritual culture context, and it is the subject that provides such a context. However, the subject, after all, exists in the modern urban spiritual culture space. As a result, on the one hand, modern urban spiritual culture space influences higher education internationalization through the subject. Such influence is especially obvious with the development and internationalization of modern city when the urban spiritual culture space assumes more aspects of internationalization. On the other hand, higher education helps to form urban spiritual culture space. The internationalized higher education profoundly changed the subject's social condition and ways of thinking and internationalization leaves its traces on many aspects of the modern urban life including urban linguistic environment, living environment, urban public place, the work, and the related urban culture. Modern philosophy believes that space is formed, to a certain extent, by the distance between the subject and object. From this perspective, the mutual influence between modern urban spiritual culture and higher education internationalization is the result of their distance and their mutual effects are due to

the existence of the subject which acts as the bearer of spiritual culture.

Secondly, the subject guarantees the historical continuity of the modern urban spiritual culture space and higher education. The continuance of modern urban spiritual culture from the history and the present to the future produced the historical space of urban spiritual culture. History and culture play a very important role in the city's internationalization. The characteristics of a city's culture and even the individual's behavior share the prominent features of the historicity in this area. Such historicization stimulates the extension of the urban spiritual culture space and, at the same time, the subject who realizes such extension is deeply influenced during this process.

As a manifestation of the city's spirit, the modern urban spiritual culture space promotes human beings' self-awareness and self-education through the expansion of historical space. There is no doubt that higher education plays a crucial role in it. Before the cities in China become internationalized, higher education expands urban spiritual culture space through the construction of subjects. With the ongoing internationalization of the city, that of the higher education follows; the subject embraces the resultant changes; urban spiritual culture space expands further, transcending the constraint of time. If the subject of the traditional higher education reacts up urban spiritual culture space only through the expansion of historical space, the extension of the subject under the influence of internationalization enable the modern urban spiritual culture space to expand in the horizontal dimension, namely in various domains.

Thirdly, in the "thirdspace", the subject plays a pivotal role in the interactions between higher education internationalization and the multivariate extension of modern urban spiritual culture space. According to the "thirdspace" theory, in the modern urban space, new things appear everywhere and they disturb the order of the old mainstream culture. If the interrelationships among higher education, the city's internationalization, and the urban spiritual culture space and so on are observed from a traditional dialectic perspective, the problems cannot be solved. In other words, traditional urban spiritual culture space, through the interaction between the subject and higher education internationalization, produces "thirdspace", namely the expanded space from the original space itself. The crux in sorting out the relationships among these elements is the understanding of the crucial significance of the subject's role as the pivot.

### **3. The Subject of the Construction of Urban Space of Material Culture: The Material Mediator of Higher Education Internationalization**

Space, as the representation and mediator of the relationships among the various social beings, is not merely the continuation

and extension of spiritual culture but it is closely related to social reality and the material aspect of the society. The ideas on urban material culture space pay more attention to the materiality which human beings' urban cultural life is based upon. This kind of materiality, on the one hand, includes the materiality of the human body and its construction of the space. On the other hand it also includes the materiality of the nature produced and observed by human beings and those things related to it. Briefly speaking, space is the product of human beings' active practice and to a certain degree stimulates their development and the construction of the subject.

The urban material culture's role in the construction of the subject is manifested everywhere and Lefebvre's analysis on the space structure has given profound inspiration for the exploration of this issue. Lefebvre believes that "space is social product" (1991, p.26). There are three levels of production, namely, "spatial practice", "representation of space", and "representational spaces" (1991, p.33). "Spatial practice" enunciated the way human beings create, use and feel the space, the human behaviors in this space, and the consequence of such behaviors (structure of space) which includes the results of producing, using, controlling and changing this space. "Representation of space" is "conceptualized space, the space of scientists, planners, urbanists, technocratic subdividers and social engineers, ...Conceptions of space tend, with certain exceptions to which I shall return, towards a system of verbal (and therefore intellectually worked out) signs" (1991, p.38). Thus, representation of space implicates the ways of representing this space, including its outlook and significance and the instrumental spaces such as maps, math, social project and city plan which are produced through knowledge and logic. The "representational space" is the space as directly lived through its associated images and symbols, and hence the space of 'inhabitants' and 'users', but also of some artists and perhaps of those, such as a few writers and philosophers, who describe and aspire to do no more than describe. This is the dominated—and hence passively experienced—space which the imagination seeks to change and appropriate. It overlays physical space, making symbolic use of its objects. Thus representational spaces may be said, though again with certain exceptions, to tend towards more or less coherent systems of nonverbal symbols and signs. (Lefebvre, 1991, p.39)

Human beings' practical activities that produce, use, control and change the space play a crucial role in the production of urban material culture space. The relationship between the production and extension of urban material culture space and higher education internationalization, to a certain degree, conforms to the three levels of space enunciated by Lefebvre in terms of its materiality.

Firstly, the subject produces the urban material culture space in which higher education internationalization develops. The urban material culture space is the material basis of urban culture, including the city residents as the subject, the landscape, public places, and institutions for art or scientific researches which shape

the taste of urban culture space and so on. It is also the material basis of the development, characteristics, and resources of urban culture. Furthermore it evinces the features of the city's spiritual culture. It is easy to see how the subject produces material culture space from the following aspects:

The first aspect is the city residents who receive excellent internationalized higher education. The residents are the subjects who use the urban culture space and they are also part of the urban culture landscape. As the physical "human beings", people of diverse age groups, different genders and educational backgrounds make up the city's considerably stable social strata; their daily life forms the backdrop of urban culture and their demand for higher education increases with the speeding urbanization. The stratification of the residents as bodily individuals directly influences higher education internationalization.

The second aspect is the city landscape which has its connotations and unique styles. The city has produced rich urban material culture during with the ongoing urbanization and internationalization. The city's rocks, mountains, grasslands, trees, rivers, and also its buildings, places for work, culture squares, statues, artistic squares, means of transportation, and apparels of the pedestrians and etc. all reflect the mood and aesthetics of the city's residents. The landscape is the material representation of the taste of the city's culture and also the demand for the extension of urban culture space. It is partially the product of education and in return influences education because higher education determines the formation of urban culture space and the subject's way of producing material culture determines how the significance of space is produced.

The third aspect is the city's institutions for art or scientific research which are directly related to higher education. The existence of these institutions reflects the development of the city and its higher education. The city's internationalization spurs the development of these institutions on to meet the international standard and the prosperity of science and art invigorates its urban culture space.

Secondly, the subject represents the material demand for and achievement of higher education, and effectuates the representation of material culture space. As been stated above, the representation of space is to ensure the relationship between things and groups of people in space through knowledge and logic. The interrelationship between the subject, urban spiritual culture space and higher education internationalization is mentioned above and the urban material culture space is exactly represented by the constant extension of urban spiritual culture space. For the current status of higher education internationalization, this kind of representation mainly guarantees the horizontal, or international,

extension of culture space without damaging its historical continuity. Just as Lefebvre said, both city plans and social projects are the representations of the material demand for the higher education. The city's internationalization enables this kind of representation to be embodied on two levels: the first level is that higher education internationalization has the educational cooperation, recruitment of foreign students and induction of foreign teachers and so on as its basic material conditions; the second level is that the ideas of higher education internationalization needs to be practiced by the subject in social culture through spiritual culture space.

Thirdly, higher education internationalization permeates into the subject's everyday life, constructing and extending urban material culture life. This process is also what Lefebvre called "representational space", and it is the space of life with significance and symbols, which reproduce and change with time. Certainly, it is the subject that occupies this imagined space. The subject understands higher education and its internationalization through a more abstract way, namely symbols or signs. In other words, higher education and its internationalization influence the subject's thoughts and behaviors which change with time and finally promote the development of urban material culture.

In summary, the subject plays a very importance role in the construction of urban culture space. Obviously, the article only does theoretical research from a cultural perspective and intends to invite critical suggestion, hoping to provide theoretical guidance for more complex empirical researches which pivot around the interaction between culture space and higher education internationalization and emphasizes the role of the subject as the mediator.

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# Strategic Planning for the Development of Urban Areas Based on an Analysis of Socio-environmental Risks: the Experience of Designing the Rehabilitation of the River Temernik

*Tatiana Anopchenko & Ksenia Boeva & Anton Murzin & Alla Temirkanova*

(Southern Federal University)

**Abstract:** The study is an attempt to comprehensively study and summarize the main problems and risks associated with the current state of the Temernik River and develop on this basis a plan of short-term and long-term measures for improving the basin of this natural city street and integrating it into the architectural and landscape carcass of Rostov-on-Don. The aim of the project is to improve the living conditions of city residents based on transformation of the source of environmental contamination into the park recreational space of citywide importance. The project received the approval of the Governor of the Rostov region, emphasizing the importance and urgency of solving the problem of the river Temernik. The Ministry of Natural Resources and Ecology of the Rostov Region initiated the involvement of a wide range of state and municipal employees, scientists and specialists, representatives of public organizations in the discussion of the problem.

**Key words:** strategic planning, urban development, socio-ecologic risk, Rostov-on-Don, Temernik river

## Introduction

Thus, our city-forming river owes its name to one of the most difficult periods in Russian history, defined as the Mongol-Tatar yoke. The name of the river in Turkic means "iron". There is also a version that the river is named after the great Mongolian conqueror Tamerlane, whose name from the same Turkic translates as "iron lame".

Peter I decided the beginning of the city about the construction in 1695 of a small shipyard here for repair and equipping the ships of the Azov Flotilla. This decision was justified by two factors: the presence of wide and deep backwaters at the confluence of the Temernik and Don rivers, as well as the nearby source of drinking water.

After the defeat of Russia in the Russian-Turkish War and the conclusion of the Prut Peace, the Temernik River becomes the western border of the state from 1711, and the border and customs garrisons stationed on the site of the former shipyard. It

was these settlements that became the stronghold for the construction of the fortress, which laid the foundation for the city.

The subsequent development of the city at an early stage closely connected with the development of the territory bounded by the left bank of the Temernik River in the west and the forstadt fortress in the east. At the same time, the active development of the coastal areas of the river and its tributary, the General beam, as natural channels for the discharge of liquid and solid wastes begins.

The first visible symptoms of degradation of these reservoirs expressed in the appearance of unpleasant odors, waterlogging and soil erosion, also belong to the same period. Concerned about this, the city government is developing a system of measures for the organization of urban storm sewerage, the first concrete embodiment of which was the construction of the first underground reservoir, a length of 1.7 km under the bombarded General beam.

This structure put into operation in 1893, which made it

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**Author:** Tatiana Anopchenko: Dean of Management Faculty, Southern Federal University, 344006, Rostov-on-Don, Russia, +7(863) 2184000. Tatiana Anopchenko graduated in 1993 from the Rostov State University, majoring in Economic Cybernetics, qualification as an economist-mathematician. Received a doctorate in economics in 2008 and a professor in theory and technology in management in 2010.

Ksenia Boeva: Lecturer of Management Faculty, Southern Federal University, 344006, Rostov-on-Don, Russia, +7(863) 2184000. Ksenia Boeva graduated in Southern Federal University (01.09.2004 - 30.06.2010) in the direction of History Bachelor, Master. Has passed improvement of professional skill (18.04.2013 - 17.06.2013) Accounting and taxation with use of information technologies; North-Caucasian Federal University, Stavropol (24.02.2015 - 07.03.2015) Modern technologies of strategic management of the organization.

Anton Murzin: Docent of Management Faculty, Southern Federal University, 344006, Rostov-on-Don, Russia, +7(863) 2184000 admurzin@sfnu.ru. Anton Murzin in 2001-2002, worked in the marketing department of State Unitary Enterprise "Center ERTSOS", in 2002-2003. - head of the regional representative office of OJSC "Grand", in 2003-2008 - an economist-appraiser of OOO "SINTEKS", since 2006 - Associate Professor of the Southern Federal University.

possible to organize the discharge of storm and domestic sewage from the entire central part of the city. It is worth noting that due to the reconstruction carried out in 2010, the general collector has been successfully operating now.

The development of a metropolis in the 20th century accompanied by a sharp increase in civilizational pressure on the southern part of the Temernik river basin, gradually absorbed by new factories, factories and urban areas. As a result, more than half of the entire catchment area of the river was within the boundaries of the city. It is worth noting that the anthropogenic impact of the growing metropolis during this period largely compensated by two major events that were of cardinal importance in the formation of the habitat.

First, we are talking about the creation of a citywide system for the transport and treatment of wastewater in 1973-1975. By the end of the century, the length of the city sewerage network was 1.2 thousand km, which allowed the centralized discharge of the most biologically active domestic wastewaters, by passing the Temernik River, through a complex of treatment facilities located on the left bank of the Don.

At present time, 87% of households covered by the city water drainage system. Secondly, the crisis phenomena in the economy of the 90s contributed to a sharp decline in production in the city. Market transformations in the system of property and land relations served as an incentive for the withdrawal of a large number of enterprises and organizations whose activities accompanied by significant pressure on the ecosystem of the Temernik River Basin.

Sanctioned and unauthorized bridges, crossings, hydraulic structures, artificial reservoirs, land reclamation facilities, ponds, channels for discharging liquid waste from agricultural enterprises are being built. The largest sources of pollution in rural areas are mineral fertilizers and pesticides that enter the river basin because of surface run-off from the soil, as well as in violation of the rules for air treatment of crops, regulations for transportation, storage and use of fertilizers and pesticides.

A consequence of this is the eutrophication of the reservoir - an increase in its biological productivity because of the accumulation of nutrients (nitrogen, phosphorus) in water. The physico-chemical properties of water deteriorate. It becomes turbid, green, it has an unpleasant taste smell, acidity increases. During the mass extinction of algae, their decomposing remains accumulate on the river bed. The products of the breakdown of algae absorb the oxygen of water, and some of them are toxic.

All this has a negative impact on the state of the whole water basin of the river, preventing the natural flow of water and the nature of the organization of washing regimes in flood periods. Signs of the degradation of the river are everywhere - almost all along its length - and expressed in bogging of individual sites, overgrowing with reeds and reeds, which is a favorable environment for the reproduction of blood-sucking insects.

#### **Literature Review. Environmental risks**

Taking into account the absence of a permanently operating system for monitoring the ecological condition of the Temernik River, the identification of the current situation risks for the inhabitants of the metropolis is possible on the basis of the use of general data of geological, biochemical and other studies of different departments conducted at different times, to varying degrees affecting its basin (Anopchenko at al., 2015; Bakaeva & Ignatova, 2014; Bakaeva at al., 2015; Drobasheva at al., 2003; Drobasheva & Rastoropov, 2005).

#### **Methodology. Environmental risks**

Such risks include the following.

##### ***Epidemiological risks***

The first systemic measures for epidemiological monitoring of the cholera situation, including laboratory studies of environmental objects were organized in the late 60's and early 70's of the last century in connection with the registration in the territory of Rostov-on-Don of local foci and outbreaks of the disease. During the investigation, it found that 80% of the cases of infection of the population are due to the use of water for household purposes Don and its tributaries, including R. Temernik.

The leading role of the water factor in the distribution of cholera has determined the priority of studies of the effect of constituents of ecological water systems on the duration of conservation and the properties of cholera vibrios. At the same time, a clear interrelation between the intensity of the isolation of cholera vibrios, the content of ammonium nitrogen in water, and synthetic surfactants SS - Synthetic Surfactants, with the number of blue-green algae and diatoms is established.

The results of long-term (1992-2007) biological testing data for the Temernik estuary testify that the level of toxicity of the river belongs to the 4-5 classes, which is classified as extremely toxic, and the ecological status is both poly- and hypertoxic.

Analysis of biotesting data, carried out in 2011-2012, showed that the toxicity of waters and sediments of the River. Temernik is heterogeneous both in degree and in spatial aspect. So, throughout the investigated section of the river (from the mouth to the sanatorium “Nadezhda”), acute toxic effects of the water and bottom components of the river ecosystem and the absence

of toxicity noted. Individual local toxicity points identified.

Modern chemical-analytical laboratory studies of selected samples conducted in 2015, including the determination of the pH of water, indicate that the most polluted are the waters of the urban part of the Temernik River. Characteristics of toxic effects for a number of indicators are given in table 1.

**Table 1. Exceeding the MPC of pollutants in selected areas of influence**

Defined component	The multiplicity of MPC excess by sites		
	Upper reaches of the river, length 12,5 km	Zone of the Northern Cemetery, length - 3,6 km	Within the boundaries of the city limits, length - 4,2 km
Sulfate ion	4,34	2,88	3,29
Ammonium ion	1,61	8,80	3,63
Nitrate ion	0,21	0,79	1,14
Chemical oxygen demand	1,42	3,19	1,78
Biochemical oxygen demand	1,38	0,64	1,17
Cadmium	1,00	3,00	1,00

A number of studies have noted a decrease in the level of toxicity of the reservoir at the site of measures for cleaning the river and removing bottom sediments. At the same time, these and other studies conducted at different points and at different times do not give a complete picture of the biological state of the entire water system of the Temernik River basin, do not allow us to assess the dynamics and duration of the associated positive or negative changes.

***Risks of sediment accumulation***

In the environmental assessment of water systems, bottom sediments are one of the most informative objects of study. Accumulating the pollution that enters the reservoir for many years, bottom sediments are an indicator of the ecological condition of the territory, a kind of integral indicator of the level of contamination.

Bottom sediments represent an inseparable unity of a complex of minerals and an aqueous solution that impregnates deposits. This same aqueous solution physically and chemically combines a set of discrete grains, mineral phases and organic residues into an integrated system. A variety of chemical reactions take place in this system, a redistribution of the dissolved components takes place. In the aqueous solution and on the surface of the grains live the bottom microflora, which exercises an important influence on the course of chemical

processes in the bottom sediments and the vital activity of organisms.

Technogenic deposits, accumulating pollutants, to some extent neutralize toxic emissions of technogenesis, especially at the initial stages of pollution. However, the buffer capacity of deposits relative to pollutants is limited: even with the complete cessation of wastewater discharge into sediment watercourses, sediments are a secondary source of contamination of water mass, biota, floodplain landscapes for a long time. Chemical reactions and microbiological processes that occur in them contribute to the formation of mobile and toxic compounds of many pollutants.

The greatest contamination associated with the accumulation of bottom sediments exposed to the lower part of the Temernik River, where water and solid effluents from the Bezymyanny Creek, Zmeevskaya Balka and directly from the adjacent streets and ravines arrive. According to expert estimates, the amount of sediment in this area is about 600 thousand cubic meters. Especially severe sanitary and environmental conditions have developed on the river in the vicinity of the zoo and the mouth of the Zmeevka gully, where the river bed is completely filled with deposits. The depth of sedimentation of silt here exceeds 5-6 meters. On the lower part of the silt, the river bed was also filled.

The presence of a significant number of unauthorized releases of untreated and non-disinfected domestic wastewater, mainly from private households located on non-localized territories, leads not only to microbial, but also parasitic pollution of water and, accordingly, bottom sediments. So, according to the results of laboratory tests carried out by the testing laboratory center FBUZ "Center for Hygiene and Epidemiology in the Rostov Region" in November 2013, in the samples of bottom sediments collected from the river Temernik in the Zoo and below the dam of the Lower reservoir, eggs of helminths were found in amounts permitting sludge to be classified as "extremely dangerous" in the epidemic context.

#### ***Risks of flooding of vast territories***

Flooding is a sharp increase in the water level in the river. Regardless of the reasons for the occurrence (there may be several), the phenomenon differs from the flood by its short duration and suddenness. That is, when the river or lake after the rain or the sudden melting of snow comes out of the coast, this is the flood. The meaning of the word rather accurately determines the essence of the process.

If we consider the events preceding this phenomenon and become its main cause, then there may be several. Firstly, a long pouring rain, as a result of which the pond comes out of the

banks; Second, the intensive melting of the snow in the winter-spring time. The period of high water after intense precipitation is usually very short and lasts literally for several hours. However, because of its rapidity, even such a short-lived phenomenon can cause serious damage (Burima & Makushchenko, 2015). In case of repeated downpours in the same territory, there are sometimes multi-peak floods. This event characterized by a periodic flood of reservoirs with the flooding of nearby territories.

The loss of the capacity of the Temernik River due to the high degree of channel silting, as well as the technical imperfection and wear of some of the hydraulic structures, creates a threat of flooding of the city territory with very insignificant rainfalls (Chan et al., 2012).

According to information compiled based on recorded facts and observations by the Department for Prevention and Elimination of Emergencies of the city of Rostov-on-Don from 2009, in the flood zone of the river. Temernik with floods 10-25% of the supply, large urban areas fall into a total area of 360 hectares (table 2).

**Table 2. Volumes of possible flooding in case of floods 10-25% of availability**

<b>Flood flooding facilities</b>	<b>Area, hectares</b>
Residential houses and infrastructure	19,60
Industrial and municipal enterprises, facilities and facilities	0,02
Communications, engineering and other structures	26,00
Plows, gardens, incl. Residential houses in horticultural associations	314,20
<b>TOTAL</b>	<b>359,2</b>

#### **Findings/Results. Strategy for the rehabilitation of the Temernik River**

Obviously, the overwhelming majority of residents of our millionth city are interested in ecological rehabilitation of the Temernik River, regardless of age, gender, political or religious beliefs. At the same time, effective measures in this direction will inevitably encounter the resistance of some households and enterprises whose activities contribute to the pollution of the river and its tributaries. Therefore, one of the main tasks of such a project is the coordination of various and partly conflicting interests. The development of the mission is the starting point for

any improvement of the management system, since it allows determine what is the main objective of the project, to outline short-term and long-term action plans.

Based on generalized data and international experience, the mission statement, the purpose and objectives of the project proposed as follows:

Mission: in harmony with nature and the laws of the development of society, we provide a new quality of the urban environment through the ecological rehabilitation of the Temernik River basin and the transformation of the focus of environmental contamination into a public recreational park.

The goal of the project is to create a linear landscape

ecological park in the urban part of the Temernik river basin after implementing a set of measures to prevent further anthropogenic pollution and restore its viability. To achieve the goal, three tasks are to be solved (figure 1):

1. To carry out a full inventory of the river basin in order to identify all sources of pollution without exception, identifying their owners, studying and technical certification of all authorized and unauthorized hydraulic structures, bridges, and entering all the information received into the GIS model of the river basin of the river Temernik.

It is also necessary to carry out a set of measures to organize the posts of ecological monitoring of the state of the river basin with the definition of the composition and frequency of the studies and the creation of an electronic data bank integrated with the geo-information model of the river network.

The indicator of the task's fulfillment will be the working multi-layer geoinformation model (figure 2) of the Temernik River basin, which allows monitoring and analyzing the current state of the river in a real-time mode for a number of selected indicators, as well as the changes that are taking place.

Figure 1. Hierarchy of the goals and objectives of the project

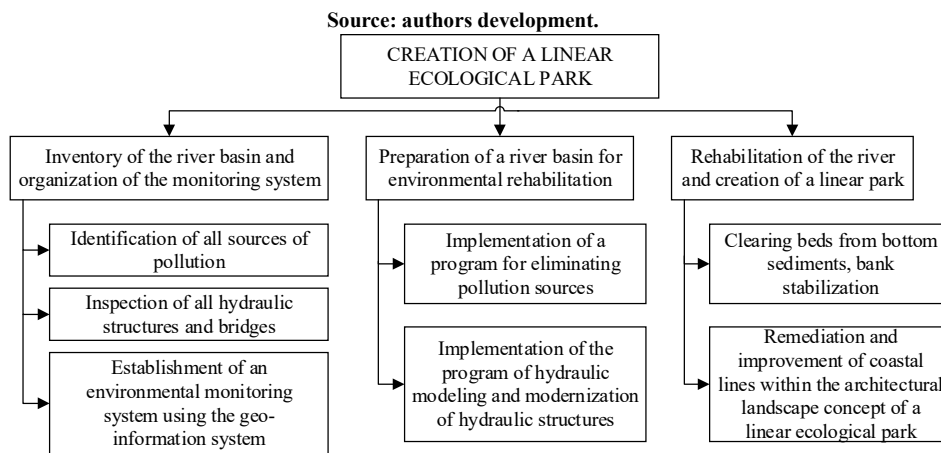
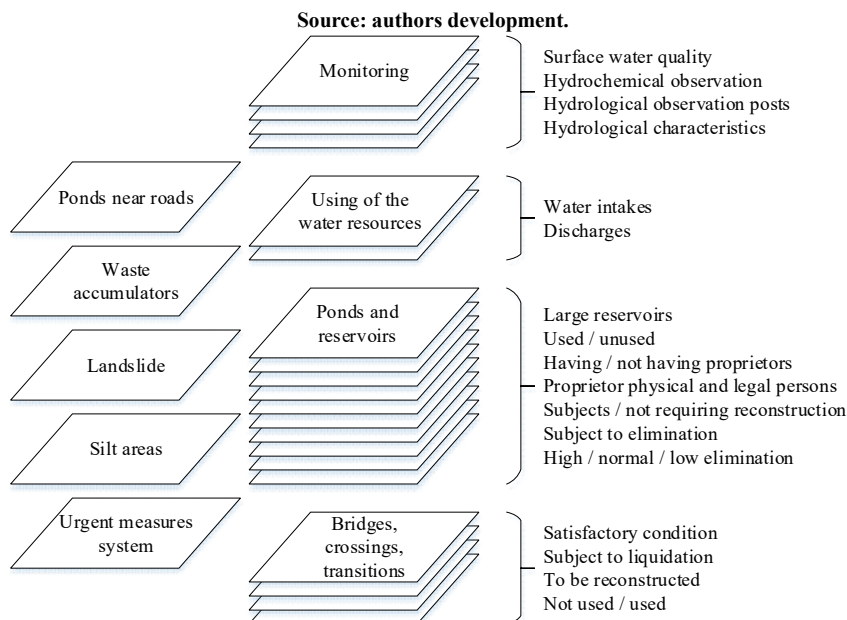


Figure 2. Structure of the multi-layer geoinformation system of the basin of the arm Temernik



Environmental monitoring should be carried out within the framework of a single system of state environmental monitoring,

and the system of its indicators is adapted to the relevant practice of state monitoring.

An important direction of activity at this stage will be the development of the project of planning and surveying the linear space (Castán Broto, 2017). This will determine the boundaries and ways of using coastal areas, create an image of a citywide ecological park, offer architectural landscape concepts for the urban and rural parts of the Temernik river basin.

2. The preparation of the river basin for environmental rehabilitation includes a set of measures aimed at establishing and formalizing, within the documents of the territorial planning of all three municipalities, the boundaries of the guard zone of the future linear park.

Much work remains done to eliminate sources of anthropogenic pollution, including compensatory and administrative measures in relation to households, enterprises and organizations, whose activities accompanied by unorganized discharge of waste into the river basin. A separate direction will be the provision of a centralized household and storm sewerage of a large number of households, horticultural cooperatives, enterprises and organizations. Such programs implemented in the river basin must be integrated into the programs of social and economic development of all three municipalities and be reflected in regional and federal target programs, investment programs of communal organizations and plans for integrated development of territories.

Simultaneously, within the framework of the solution of the common task, it is necessary to carry out geological and hydraulic engineering surveys to create a hydraulic model of the Temernik river basin, based on accurate knowledge of the potential of surface, underground and other sources, which allows to optimize the process of hydro-technical regulation of its watercourse. Based on this model, the entire hydraulic control system must be modernized in order to eliminate the risks of flooding of territories and man-made accidents (Douglas et al., 2010).

Obviously, it takes a long time to fully implement this task. Objective indicators that allow monitoring the dynamics of positive changes in this direction will be objective monitoring data obtained from the current geoinformation model of the river network.

3. Clearing of the river and organization of a linear ecological park in the urban part of its basin.

Realization of the two described tasks in full allows to begin real work on rehabilitation of the river basin. At the same time, all designed measures-clearing from bottom sediments,

expanding channels, strengthening coastal lines and subsequent improvement, should be subordinated, formalized in the form of an architectural and landscape concept to the idea of a linear park.

To realize the task in full, the concept of landscape design of the Temernik river basin should also include architectural and planning solutions for suburban sections of coastlines in the Myasnikovsky and Aksay districts.

#### **Discussion. Strategic plan for project implementation**

The proposed project implementation strategy consists of three areas:

- 1) management strategy;
- 2) communication strategy;
- 3) investment strategy.

The management strategy implies the delegation of a number of functions related to the monitoring and rehabilitation of the Temernik river basin by a special structure in the form of a non-profit association (NCO). This structure allows you to accumulate budgetary and extra-budgetary sources for solving project tasks, has sufficient flexibility in implementing inter-agency communications and independence.

Given that the river basin borders are located in three municipalities, the river basin management should be implemented at the oblast level by the Ministry of Natural Resources and Ecology, and all functions related to the transformation of coastal spaces into a linear ecological park are transferred to the NCO. To implement such a management strategy, it is proposed to make a change To the law of the Rostov region dated 11 March 2003 N 316-3C "On environmental protection in Rostov Region" with the inclusion of a section defining the status of NGOs in it, as well as the procedure for concluding a state contract for rendering services for the state needs of the Rostov Region to create a linear ecological park in the Temernik river basin and attracting investments for the implementation of monitoring and environmental rehabilitation programs.

Communication strategy is aimed at achieving the necessary level of trust on the part of society. One of the main tasks of NCOs at the first stage will be the formation of an information system that provides broad access to all the documents created during the project implementation, as well as a reliable feedback system.

The main directions of the NGO's work on the implementation of the communication strategy could be formulated

as follows:

1) the formation of a stable public opinion on the need for a state, integrated, systematic, scientifically grounded approach to the issue of ensuring environmental safety in the Temernik River basin;

2) involvement of the media with a view to popularizing the issue of ensuring ecological balance in the urbanized areas in general and in the city of Rostov-on-Don in particular;

3) formation of a broad public discussion and political agenda with the involvement of young scientists and politicians, as well as people's deputies of all levels;

4) participation in scientific and educational activities involving students and post-graduate students of technical universities and research organizations for research and development;

5) formation of an information database of scientific research and innovative ideas in the field of technological and technical and architectural and planning solutions to ensure the environmental sustainability of urbanized territories and water bodies;

6) formation of proposals to public authorities on the planning and implementation of activities aimed at ensuring environmental balance and nature development in urbanized areas;

7) public control of the ecological situation and the formation of communities in social networks on the ecology of urbanized territories and water bodies;

8) organization of interregional and international cooperation and information exchange on ensuring the ecological balance of urbanized territories and water bodies.

The investment strategy includes a set of measures to formulate justifications and applications for federal support through state targeted programs, international loans and grants, and the organization of partnership projects to attract private investment.

Given the complex and multilevel set of tasks accomplished the horizon for long-term planning of project implementation activities is proposed to adopt the corresponding general development plans for the city and districts, i.e. until 2025 (table 3).

**Table 3. Timetable for the implementation of the Temernik River rehabilitation project**

Tasks	2015	2016	2018	2021	2022	2023	2024	2025
Definition and introduction in the general development plans until 2025 of the city boundaries of coastal lines of linear park areas								
Creation of the basin structure of project management								
Inventory of a river basin								
Preparation of a river basin for rehabilitation								
Creation of a continuous linear fleet								

The proposed sequence of actions consists of five main stages:

1. The initial stage (2015-2016 years). Formalization of linear park zones in documents of territorial planning to specify the boundaries of management impact associated with the implementation of the project. Development of the project of the water protection zone of the Temernik River. To implement the idea of creating a continuous park space throughout Russia Temernik is required that this functional zone be established in the master plan and land use rules and the development of the city of Rostov-on-Don, the general planning schemes for Myasnikovskaya and Aksai districts, along with other areas of parks, squares and other “green” spaces that make up the natural and landscape framework of the city and rural settlements.

2. Organizational stage (2015-2016 years). Formation of the concept of legal and content design of the river basin management structure. Amendments to the regional legislation, development and implementation of the procedure for competitive selection of NPOs and conclusion of a contract with the winner. Development, public discussion and approval of the Strategic Management Plan for the river basin for 2016-2025.

3. Research (2016-2018 years). Work on the inventory of the river basin with the identification of all sources of pollution, inspection and certification of hydraulic structures and bridges, creating a multi-layer GSI system that allows real-time monitoring of the river basin and monitoring changes associated with the implementation of certain stages of the environmental rehabilitation project. The creation of such a system represents

the basis for the formation of projects to attract investment from budgetary and extra-budgetary sources for the provision of resources for practical activities.

4. Preparatory (2018-2022 years). Multidimensional, complex and conflicting work to eliminate all sources of pollution, which involves interrelated practical measures at all levels of government, enterprises and households in various departmental programs. In parallel, the hydrodynamic model of the river formed, on the basis of which the entire complex of hydraulic structures and bridges are modernized. At the final stage of the preparatory phase, when the environmental monitoring data unequivocally point out the effectiveness of the measures taken, the process of preparing specific architectural and landscape solutions for the coastlines and the development of design estimates for the work on the river clearing and the arrangement of park areas begins.

5. The stage of practical implementation (2023-2025 years). Implementation of contract works with the installation of park areas.

### Conclusions

The proposed river basin rehabilitation project is a continuation and development targeted ecological program for the rehabilitation of the Temernik River, currently under way. The implementation of this project will allow us to reach a new, higher level of relations between the urban community and the river. The task of overcoming the negative impact of the river on the city, carried out in recent years, transformed into a strategy for integrating its basin into the architectural and landscape framework of the city in a new quality - the image of a citywide ecological park.

Project initiators understand that the achievement of the project's goal is impossible without the support of all levels of government and the regional society as a whole, therefore, ensuring transparency and professionalism at all stages of practical work is considered to be the main elements of the implementation strategy.

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# A Preliminary Exploration on Sustainable Strategy of City Development with MICE : A Case Study of the 21st Guangzhou International Lighting Exhibition & LED Asia

*Qianhui Ouyang*

(Macau University of Science and Technology)

**Abstract:** A city is not merely a centre of population and a cluster of the modern industries, but also having intimate relationship with regional economics. The development of the city is conducive to promoting the overall prosperity and development of a nation. MICE is widely concerned by the world's attention for its strong promotion of urban economic development. Those large and medium-sized cities both in China and around the world, have made great efforts to develop MICE as an urban brand. However, the rapid development of convention and exhibition industry has brought pressure as well as challenges on urban management and environmental sustainability. This article takes the 21st Guangzhou International Lighting Exhibition (GILE) and Asia LED Exhibition as an example to have a comprehensive analysis and provide suggestions for potential risks that might happen when developing cities sustainably with the strategy of the convention and exhibition as its brand.

**Key words:** MICE, Guangzhou, Sustainable Development

## 1. Urban development and MICE industry

Since their inception, cities have been regarded as a symbol of human civilization and as an inevitable outcome of social and economic development. According to K.J. Barton, a British economist, "a city is a network of interconnected markets of various kinds (housing, labour, land, transport, etc.) situated in confined spaces." "With the background of economic globalization, the structure and function of cities have evolved into centres of knowledge and information, where the tertiary industry has gathered and become increasingly used for information and knowledge production and Polygamy as well." (You Jian-xin, 2006). With the global urbanization process, the city has entered a booming stage. MICE includes Meetings, Incentives, Conventions and Exhibitions, which are often referred to as the convention and exhibition industry in China. As MICE activities are often concentrated in urban areas, and are a significant part of urban economic development, the development of the MICE industry is generally regarded as an urban development strategy (Law, 1993; Murphy, 1997). MICE has become an important industrial sector in the economic structure in some developed western countries, as well as in Japan, Australia, Singapore, Hong Kong and other countries and regions (Zhu Haisen, 2004). At the same time, some professionals believe that the development of MICE tourism can promote the city economy, enhance the construction of the city image and appearance, increase the urban employment

opportunities, and accelerate the exchange rate of technology and information between cities (Cao Xinxiang, 2004). In fact, MICE has become a global industry due to its strong promotion effects on the urban economic development. However, there are still some issues such as central city fragility, economic stagnation and population growth, leading cities into negative conditions like a dramatically increased population base, innovative capacity, outdated planned reliance and inefficient ecological management (REECE, 2010). Those visible or invisible benefits and risks make "the feasibility of developing cities with the strategy of MICE brand" become an important research topic for city managers.

## 2. Guangzhou Convention and Exhibition Industry and GILE

Guangzhou is one of the regions that have the earlier awareness of developing MICE than other places, and it plays an active role in MICE economics as well. Convention and exhibition industry in China started from Guangzhou, and then to the whole country and to the world. The statistics of the Guangzhou Blue Book: Economic Development in Guangzhou (2016) shows that the number of exhibitions in Guangzhou in 2015 was 197, ranking the third place in China; the total exhibition area was 10.41 million square meters which was in the second place; the exhibition area took 57218 square meters per each on average, ranking first place in China. In 2016, 538 exhibitions were held in Guangzhou City and the exhibition area

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**Author:** Qianhui Ouyang, Macau University of Science and Technology.

was 8.965 million square meters, which increased by 4% and by 11.6% respectively compared with the last year, thus making Guangzhou own the second exhibition area in China. The key venues in Guangzhou held 1852 international and regional conferences, with more than 100 attendees per each conference, which showed year-on-year growth of 21%. A number of well-known brand exhibitions including the Canton Fair, Guangzhou International Lighting Fair, China Guangzhou International Furniture Fair and China (Guangzhou) International Auto Show, which are also known as “China’s First Exhibition”, have become the mainstay of Guangzhou’s convention and exhibition industry. (Fu Lian Ying, 2017). In 2017, the world-class city roster of 2016, released by GaWC, the world’s most authoritative world city research institute, showed that Guangzhou was first selected in Alpha-level, and became one of the 49 world first-tier cities in the world. It indicates that Guangzhou has not only won trust nationwide, but also gained international recognition.

Guangzhou International Lighting Exhibition (GILE) is the largest lighting industry exhibition in the world. It not only strongly promoted the development of high-tech lighting industry in Guangzhou and the construction of an innovative city for Guangzhou, but also became the major platform for China to promote its high-tech lighting and the related lighting products worldwide. GILE then contributes to the co-operation between various countries and regions, especially in economic development and technological exchanges. It is reported that the total number of tourists in the 21st GILE in 2017 was 156,898, up by 8% compared with the 20th GILE. The professional visitors were from 134 different countries and regions, and the top ten of them are Hong Kong, India, South Korea, Taiwan, Singapore, the United States, Russia, Malaysia, Australia and Thailand. As for the number of exhibitors, it reached 2,428 in the 21st GILE. In order to accommodate so many people, GILE site covered an area of 180,000 square meters with 17 exhibition halls (Sohu, 2017)

By participating personally in the 21st Guangzhou International Lighting Exhibition (GILE) and Asia LED Exhibition in June 2017, the author examined the sustainable development of convention and exhibition in urban economy with the method of fieldwork observation. This article uses the exhibition industry sustainability report template introduced by the International Exhibition Industry Association (UFI) in 2013 to conduct a comprehensive analysis of GILE in economic, social and ecological aspects. Though the sustainability reporting template for the MICE industry of this organization is not a rigorous assessment system, it clearly points the way for the sustainability of MICE. The purpose of this observation is to provide some recommendations on how to develop a city sustainably through the strategy of using MICE as its brand.

### 3. The impact of GILE on the City and Risk Analysis of

#### Sustainable Development

GILE has economic impacts on Guangzhou. The economic impacts can be divided into direct impacts, indirect impacts and potential impacts.

The direct impacts mainly refer to exhibitors themselves and the companies they represented (REECE 2010). GILE can provide a professional market for the participants where SME (small and medium sized enterprise) exhibitors can broaden their brand presence in the industry. To a certain extent, it helps small-scale producers to gain competitive advantages and compete with reputable companies in the mass market, which is of great significance to the vigorous promotion of the Guangzhou market. GILE also has a direct impact on employment in Guangzhou. At GILE, all relevant positions require more human resources and often require additional employment in order to meet the quality of service, resulting in the necessary increase in employment.

The indirect impacts are always reflected by the industries or companies who is related to the income of GILE exhibitors and organisers (Reece, 2010), such as construction companies, pavilions, hotels, transportation, logistics and so on. Most exhibitors will choose to purchase as the ideal way to build their booth. Construction companies provide expert advice on building knowledge, labour allocation, design style and material selection for payments. GILE also contributes to Guangzhou’s economy through site leasing. GILE is held in Guangzhou each year, and each exhibiting company and organiser must stay there for around three days. Therefore, GILE creates another revenue source for Guangzhou in the fields of accommodation, restaurants, transportation and so on.

The potential impacts are mainly reflected in the direct and indirect benefits that the businesses bring to their workers (Reece, 2010). Some of GILE exhibitors in Guangzhou are rewarded for incentive travel from their companies, some will go to some attractions in Guangzhou for personal purposes, resulting in a corresponding increase in tourism revenue and public transport revenue.

GILE also has social impacts on Guangzhou. Firstly, it enhanced the image of Guangzhou. Hundreds of years ago, Guangzhou won the international city image and was regarded as the multicultural centre. However, the development of other cities such as Shanghai, Hangzhou and Shenzhen has shortened the advantages of this image, thus Guangzhou faces the challenge of image differentiation. The full name of GILE is “Guangzhou International Lighting Exhibition and LED Asia”, which shows that the exhibition is based on a global perspective. GILE, Canton Fair and other brand exhibitions help Guangzhou regain the international image. Secondly, the exhibition creates new occupations for the rapidly growing population. To ensure the service quality of GILE, the job allocation should be well planned and subdivided, such as event planners, professional

receptionists and field controllers. These new jobs will help the Guangzhou government reduce the employment pressure. In addition, the diversity of work categories can improve the management structure and facilitate the distribution of work. Thirdly, it educated customers. Because the theme of GILE is lighting development and business transactions, the exhibition focuses on lighting products production, innovation and development trends. For professional buyers, they can receive the current price or name of their ideal products and other market information. For the general visitors, they can get more detailed knowledge about the lights than the store through the introducers. More importantly, those who are "educated" may be potential buyers.

Besides, GILE has impacts on the ecology of Guangzhou. In the rapid development of the city's convention and exhibition economy, the total economic output of Guangzhou is at the leading level in China. However, the rapid population growth brought many problems for Guangzhou such as resource competition with residents, traffic congestion, environmental pollution, living and construction waste disposal. The consequences are the difficulty in urban environmental protection and the worsening of ecological damage. According to the "State of Guangzhou's State of Environment in 2016", the second level of "Ambient Air Quality Standard" (GB3095-2012) implemented by Guangzhou Municipality in 2016, among the six major pollutants, the concentration of nitrogen dioxide exceeded 0.15 times and the concentration of PM<sub>2.5</sub> exceeded 1 µg / m<sup>3</sup>; the pH value of precipitation was 5.42, which was 0.18 pH units higher than that in 2015. The quality of the water was 70.0% according to the national control assessment section of Guangzhou Municipality: the back part of fairway in Pearl River in Guangzhou, and the Lion water is slightly polluted; Pearl River in Guangzhou Channel West area is polluted by moderate. In addition, Guangzhou's urban management department claims that the average annual production of construction waste in Guangzhou is about 40 million tons. In terms of disposal and utilization, the total annual utilization of the city is less than 1 million tons, and the main solution is rather traditional: to landfill as garbage. Guangzhou Municipal Solid Waste Disposal Conference announced in 2016 that in Guangzhou, a total of 688.35 million tons of household garbage had been at disposal, which means 18,800 tons of rubbish was waiting to be deal with. From other side, the total recycling of renewable resources was about 2.45 million tons while the recycling rate of waste resources in this city is only 35.4%. The data above shows that though the air and water quality in Guangzhou are improving year by year, the pollution is still serious, especially the acid rain pollution and haze phenomenon. The structure of ecological land is irrational which cannot meet the needs of urban development.

It cannot deny that GILE takes some risks to the local sustainable development, such as carrying capacity risk, security

management risk, seasonal employment risk and professional performance risk. As for carrying capacity risk, this kind of risk mainly has an impact on ecology, culture as well as natural environment. All of these issues pose serious challenges to the sustainable development of MICE in Guangzhou. In term of security management risk, it is always related to the population flow. During the exhibitions, there would be a large number of people from various places coming to the same city, therefore the host city may face the challenges which city's population control is related to. Taking the safety of the participants into account and to avoid potential attacks, everyone should be checked before entering the venue. One of the bad sides of it is that too many attendees would reduce the efficiency of supervision and increase the pressure on security guards. As for seasonal employment risk, as the duration of each MICE event usually lasts less than a week, MICE events are seasonal in nature to the extent that many employees are facing unemployment. Employment instability can lead to social instability that affects the development of cities. Some examples in GILE's performance also reflect the professional performance risk. This is a relatively common problem in the cities which make their efforts on developing MICE industry. For example, some facilities and public infrastructure cannot meet the national standard, which is called non-professional exhibition. In general, unprofessional MICE performance will only attract unprofessional exhibitors, which will also make no sense on the sustainability of conventions in the city.

#### 4. Recommendations and conclusions

As mentioned above, through the observation and analysis of the achievements that MICE industry has reached in Guangzhou, and the influence of GILE's, it can be foreseen that the MICE industry has the trend of industrialization, collectivization, internationalization, branding and ecology in the future development. With a solid industrial base, developed foreign trade, advanced infrastructures and relatively perfect industrial facilities, there is no doubt that Guangzhou will consistently improve itself with the strategy of developing MICE industry. One of the accesses to keep the leading level of MICE industry is to focus on its sustainable development. However, sustainable development must make breakthroughs in urban management and urban development mode; what is more, it is necessary for cities to change their concept from the mechanical development to that of life development which respects the laws of the city. As for the aspect of the economic development, there should be a transaction from extensive development of high energy consumption to the green development; as for the aspect of city regular operation, the change of urban management from the simple disorder to the planning, construction and management system co-ordinate mode also makes contributions to the city development. In particular, in accordance with the

principle of adapting the scale of cities to the carrying capacity of resources and the environment, we should save land and water resources as much as possible and maximize the use of natural and natural landscape resources as well, to build low-carbon cities with low energy consumption sustainable urban development in harmony with nature and man. Generally, only through abundant analysis, careful planning, efficient implementation and regular assessment, can the city have a better and more sustainable future.

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# City Life and Its Influence on the Relational Development of Young Adults: Perspectives from the Book of Proverbs and the Ghanaian Society

*Kojo Okyere*

(Department of Religion and Human Values, University of Cape Coast, Ghana)

**Abstract:** The book of proverbs, especially chapters 1-9, provides some insights into the urban culture of ancient Israel. Addressed to the young adults, Proverbs 1-9 aims at directing the desires and values of young men as they navigate through life. The fervour and commitment displayed by Israelite sages clearly show the danger urban culture poses to the young adults. As a large and heterogeneous conglomerate of individuals and their settlements, cities have been important social variables in the development of cultures and humans. The emergence of urban studies is a testimony to the growing realization that cities make a mark on the way of life of society. The phenomenon of the city, however, is not a modern reality, but a cultural fossil which continues to take on its own form and shape. Our appreciation of ancient testimonies about city or urban life could facilitate our understanding of how modern cities could contribute to sustainable life. Focusing on ancient cities in the Old Testament, we are not only looking for origins and parallels of modern cities, but also seeking to explain the past in order to illuminate the present. From a literary historical perspective, this study examines the influence ancient Israelite city had on the relational development of young Israelite adults within various contexts of life. As an important skill for urban survival, relationship is key to young adults as they negotiate through the throes of urban culture. The paper proposes that the complex challenges urban culture throws to young adults today can find inspiration from how ancient Israelite society addressed its challenges.

**Key words:** city life, perspective, city and urban life

## Introduction

For Zukin (1997,1), cities “represent the basest instincts of human society”. To have large groups of people concentrated in an area with diverse tasks and responsibilities represent a great achievement for humans who hitherto were scattered and vulnerable to larger beasts of the land and air. Holding together different people with varied skills, cities in this process of consolidation opened up their economy to include manufacturing and commerce alongside agriculture, thereby leading to the creation of bureaucracy. As a cultural fossil, modern cities have become economic, political, and cultural icons where people continuously negotiate their identities and meaning. Central to these processes of identity formation and creation of meaning is relationship; the oil that ensures the optimal function of the city. Indeed, relationship is not peculiar and limited to city life, although its nature makes it one of the key distinctive features between urban and rural life. Explaining this distinction, Lim posits that because cities attract diverse people, they create “a new order of relationships among persons, radically different from... rural areas” (1998, p. 140). Several studies show that relationships in the city are superficial and characterized by lack of proximity (cf. Mumford, 1961). Thus, Imig (1983) argues that

urban dwellers do not pay much attention to interpersonal interaction as do rural dwellers.

Perhaps the social group that is greatly affected by urban life is young adults. Defining young adults is a difficult task due to socio-cultural determinants which are varied across time and space. In this paper, however, a legal definition is avoided in favour of a socio-cultural one, and since the paper dialogues with ancient Israelite culture and the Ghanaian culture, the definition adopted has to be applicable in these cultures. Before we consider who a young adult is in the two cultures, suffice to explain briefly the basis for engaging the two cultures in this study. Although many African cultures have been linked to the ancient Israelite society through their traditions on their origins and on linguistic grounds, such as the Akan and the Ga people of Ghana, the Bemba of South African (cf. Ukpong, 2000), the basis for engaging the Akan culture and ancient Israelite culture lies not in this perceived connection. Rather, the basis for this engagement lies in the continuous use and belief in the Bible (Old Testament) by many Ghanaians by virtue of their affiliation to the Christian faith. As contemporary readers of the Bible (Old Testament), Ghanaian Christians are confronted with the culture and the life and thought of ancient Israel which on the one hand has great similarity with many Ghanaian cultures, but on the

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**Author:** Dr. Kojo Okyere is a Lecturer in the Department of Religion and Human Values at the University of Cape Coast in Ghana, where he received his BA, MPhil, and Ph.D. Dr. Okyere also has a certificate in Marketing from Chartered Institute of Marketing in the United Kingdom (CIM UK).

other hand differs considerably from them. With the increasing call for biblical scholars to contextualise their studies and make it relevant for users of the Bible within their context, this paper aims at bridging the two cultures so that Ghanaian readers of the Bible can appreciate and understand the place of the Ghanaian context in biblical interpretation.

Although set apart by thousands of years, the life and thought of ancient Israel and many traditional African societies show great similarities including their understanding of a young person. Generally, a person is considered a young adult when the person moves from the stage of dependence (childhood) into independence (adulthood). The Hebrew word translated as young person is *na'ar*. According to Bland (2002), the word refers to a “teen” or a “young adult”. Such a person’s transition from childhood to adulthood is marked by the ability for him (*na'ar* is a masculine noun) to take a partner. Thus, adulthood begins from the age when a community perceives one as liable or permissible to marry. A similar situation persists in Ghana. Marriage is an important determinant of the coming of age. Among the Akan, for instance, it is the responsibility of the father to ensure that he marries off his sons (especially the eldest son). After marriage, the son is no longer dependent on the father. An Akan proverb says; *woaso aware a tow wo pretse (if you are due for marriage then buy your utensils)*. This proverb communicates the responsibility and independence that comes with marriage. After marriage, one is no longer dependent on the parents for living.

Because of the immediacy of their transition, young adults in Ghana are considered to be inexperienced and needing guidance. Ghanaian Cities with their complex web of social settings present a worrisome situation for these young people who may still be grappling with who they are and the meanings they should assign for themselves. The interpersonal relationships they engage in from different social contexts are important mediums through which young people negotiate their identities.

From a historio-literary perspective, this study examines the influence ancient Israelite cities had on the relational development of young Israelite adults, a. As an important skill for urban survival, relationship is essential to young adults as they negotiate through the throes of urban culture. Paying attention to ancient testimonies about city or urban life could facilitate our understanding of how modern cities could contribute to sustainable life. By focusing on the nature of urban life in ancient cities in the Old Testament, we are not only looking for origins and parallels of modern equivalence, but also seeking to explain the past in order to illuminate the present. The paper proposes that the complex relational challenges that today’s urban culture throws to young adults can find inspiration from how ancient Israelite society addressed its challenges.

In order to achieve the above goals, the paper is organised

as follows. Beginning the discussion is an overview of young adults and their relational development in urban settings. This section puts into perspective three major relationships young adults in Ghana find themselves in within urban settings. Next, we look into how the Old Testament constructs the concept of city and the varied social contexts city life generated. Following is a discussion on the construction of urban life in the book of Proverbs, with specific attention to how the book constructs young adults and the varied relationships they find themselves. Finally, we explore implications from the ancient Israelite case of young adults within urban settings for their counterparts in the Ghanaian society.

### **Young Adult and Their Relational Development in Urban Contexts: The Ghanaian Perspective**

As social beings, humans consolidate their humanity through the relationships they build and sustain. From birth, humans construct a web of relationships ranging from the immediate familial context of parents and siblings to the larger world of friends and neighbours. At the youthful stage of human life, relationship appears to take on an added degree of significance as young people become more conscious of themselves and their surroundings as they construct their identities and create meanings for themselves. When young people acquire the ability to interact and relate with others in a positive way they are perceived as having gained maturity.

According to the 2010 Census, majority of Ghanaians (50.9) live in urban dwellings with a youthful population (Ghana Statistical Services, 2010). This means that a large number of young people in Ghana live in urban settings. The kind of relationship they build, thus, is key to their development and success in life. Nukunya (2003) points out that urban centres in Ghana are associated with the development of slums, organised crime, juvenile delinquency, and many other vices. With these vices on the increases, young people are mostly at risk, and this is when relationships become key to their development.

One of the key relationships today’s young people find themselves in is romantic relationship (Furman & Shaffer, 2003; Wilson-Shockley, 1995). Furman, for instance, indicates that the significance of romantic relationships lies in the role they play in shaping the developmental tasks of young people. Such tasks include identity construction, building and maintaining relationship with peers, and development of sexuality. Romantic relationships in Ghana, especially within urban settings, are increasingly become more dangerous for young people. In a study by Bingenheimer and Reed (2014), female youth in Ghana are highly at risk of coerced sex not from strangers but people they know, especially their partners. They write, “Our findings suggest that having ever had a boyfriend is the primary predictor of reporting coerced sex among young women, beyond any influence of family, school or other household socioeconomic

variables” (Bingenheimer and Reed, 2014).

Apart from romantic relationships, parent and sibling relationship continues to be an important part of the lives of young people in Ghana. After all, these are groups young people have been part of since infancy until they move from their primary home. Studies indicate that parent and sibling relationship strongly impinge on the identity and relational development of young people (Edwards et al., 2006; Sanders, 2004). Like many African peoples, a Ghanaian child lives longer with his parents before completely weaning him/herself off the parents. With increase in urbanism in Ghana, transition from childhood to adulthood has become more protracted and dynamic with factors such as age playing little role, while others such as job and sex becoming increasingly important. For instance, many Ghanaians youths continue to live with their parents until they find themselves a job. With few job places available, many young people are without jobs and continue to depend on their parents.

Peer relationship is yet another social role young people pay attention to. Critical to young people’s sense of social acceptance, peer groups exert a big influence on young people and their understanding of their social and relational development (Sullivan, 1953; Erikson, 1968). Sullivan pushes that the absence of peer group in a young person’s life could lead to psychological problems (Sullivan, 1953). However, when peer formation is put within the context of urbanism, young people would have to be weary of the kind of peer groups they join. A study by Bingenheimer, Asante, & Ahiadeke (2015) on peer influence on Ghanaian females towards sex indicates that generally female peers discourage each other from engaging in premarital sexual activity. Unfortunately, negative peer influence abounds on other aspects of life. Acquach et al. (2014), for instance, show that peer influence is a major factor for fighting among the youth in Ghana.

These biological and environmental based relationships are essential to the total development of young people in Ghana. The more positive these relationships are the likelihood of the development of confident young persons who give out their best to their societies. However, the reverse will be a society made up of many young people who become deviant and a burden to their communities. Interestingly, the connection between young people and their relational development is compounded by social and environmental setting in which they find themselves. Urban youths, for instance, are believed to be challenged by the forces of the city more than their peers in the countryside. They are born and raised in the cities and towns. They grow, develop, and act out their life drama in the cities and towns. These urban centres, therefore, serve as a crucible for the development and experiences of young people. Due to the large concentration of heterogeneous people at a given locale, urban life is characterised by “the multiplication of relationships that can

exist among people and things ...” (Simone, 2010, p. 5). What is more, several factors mediate and constrain the productivity of urban relationships. Economic structures, political forces, and socio-cultural determinants such as class and race/ethnicity form a complex web of forces that entangle and influence the relational development of young people.

In all this flux, cities are not monolithic; their dynamics further create challenges to young people as they continuously renegotiate their identities in the face of a fast moving world. For instance, within a short span, technology can transform an approach to life and in the process destabilise previous ways, and at the same time erect new approaches to life. The influx of social media, for instance, has transformed how relationships are built and managed among young people (Lenhart, Smith, & Anderson, 2015; Tinning & Fitzclarence, 1992). These developments further compound the lives of young people leading to negative reactions such as stress, violence, and depression. Being the future of the Ghanaian society, young people need the necessary support systems as they develop and manage relationships with people within the city. As argued by Anna K. Tibaijuka, the Executive Director of UN Habitat, “the state of the young in any city is the litmus test for the city’s level of sustainability and vibrancy” (Ragan et al., 2004).

#### **City and Urban Life in the Old Testament**

Construction of cities is not a modern phenomenon. As physical and cultural fossils, cities have played important roles in ancient cultures including ancient Israel. The Old Testament gives valuable insights into ancient cities such as Nineveh, Gaza, Damascus, and Babylon, all outside the territories of ancient Israel. Important cities within Israel itself included Samaria and Jerusalem. Suffice to note that although these cities alluded to in the Old Testament existed in history, this study approaches the subject of city from a literary perspective. In other words, it perceives the cities described in the Old Testament as imaginative descriptions of their authors. As Robert Alter puts it, a literary work recreates “the world from a highly colored point of view—inevitably, that of the novelist, and, often, that of the principal character as well” (2005, p. x). Alter does not deny the possibilities of novels or fictions containing or reflecting historical realities. Indeed, the Bible presents itself as a record of the past. What Alter focuses on is the fact that the literary works deal with the subjective experiences of a character. Descriptions of cities that emerge from the literary works represent the sensory perceptions of authors or characters. These descriptions may be based on material realities of the historical city, but ultimately they represent subjective experiences of the character. The implication of this perspective is that we need not be quick in equating what we read of ancient cities in the Old Testament to what pertained in their historical existence.

In the Old Testament, the most dominant word used for city

is *ṣr*. According to Frank Frick (1977) the word which appears over a 1000 times connotes the idea of “a fixed settlement which is rendered inaccessible to assailants by a wall and/or other defense works” (p. 30). Frick is of the view that the central preoccupations of ancient Israelites in building cities were the elements of defense and protection. This explains why cities in the OT are said to have walls and citadels. On the other hand, Laughlin (2006) describes biblical cities as “a form of permanent human settlement with political, social, economic, and religious relationships with its immediate surroundings” (p. 1). For Frick, however, the elements of defence and protection are foundational to cities in the Old Testament. Thus several cities in the Old Testament were described in the language of defence such as the enumeration of fortifications including the presence of citadels and walls (cf. Deut. 1:28; 2 Kgs. 17:9; Jer. 5:17; 8:14). Such fixation on defence and protection reveals the primary function of cities in the Old Testament that is security. Thus Frick (1977) writes, “The walls of a city were not intended to be the demarcation of the city limits; they rather signified the cooperative attempt of a social unit to find complete security for the place of its abode” (p. 32).

An important characteristic of biblical cities is the relative size of its dwellers, which raises the issue of the heterogeneity of the city dwellers. The share number of people concentrated in an area naturally creates specialization of skills, which in turn leads to social differentiation and stratification. Several proposals have been given on the processes behind the social structure of Israelite cities, especially during the monarchy. One such proposal is by Max Weber. He argues that few families through the accumulation of wealth emerged as the ruling class and in the process disarmed the peasants who initially were freeholders. This created class antagonism so prevalent in the Old Testament, especially in the rhetoric of the prophets (cf. Frick, 1977).

A resultant effect of the process of stratification is the extent to which the family as a social institution was affected. Scholars such as Schluter and Clements (1986) have argued that urbanisation largely influences negatively the institution of family. As the microcosm of the entire society, the family, which aims to maintain unity in order to guarantee its survival faces serious challenges in this endeavour. Weakening of kinship bonds is perhaps the most conspicuous of these challenges. Since the city is a conglomeration of people who have migrated from mainly rural settings, the desire of family members to congregate at an area as seen in the rural setup is mostly challenged. What happens then is that family members may live apart, which in turn leads to weaker and less commitment towards family bonds. According to Wirth (1938), the extended family unit comes under serious constraints by city life. He argues that family values such as maintaining family contacts and strengthening kinship ties are disrupted by the process of urbanisation. However, Frick (1977) challenges this view by

positing that in the case of ancient Israel, the main source of harm to the extended family was the institution of monarchy and not necessarily the changes urbanisation introduced. Although the monarchy is the single most important factor in the kind of social structure that emerged after its existence, its mutual ties to urbanisation cannot be overlooked. Both urbanization and the institution of monarchy were symbiotically related in a way that decoupling them gives a less accurate picture of their combining effect on the social life of the Israelites (this does not mean that urbanisation cannot thrive in the absence of the institution of the monarchy).

What is certain for sure is that the social life of ancient Israelite city dwellers was significantly different from rural dwellers. For instance, the cleavage between the ruling elite and the citizenry created disenchantment on the part of the latter as their lives were structured in a manner that sought the interest of the former. R. B. Y. Scott (1968) captures this as follows:

*The desire for security and satisfaction then, was the mainspring of social action, and determined most decisively the form of the social order and the quality of its human relationships. Within the Israelite society certain individuals, groups and classes had attained a position of dominance and privilege through the exercise of power, the influence of prestige and the possession of wealth; and the latter means were continually being sought for the former ends. The interests of society as a whole were ... too easily identified with the interests of the ruling class (p. 183-4).*

In many ways, this affected the relational demand of city dwellers. Mumford (1961) opines that because of “the wider the area of communication and the greater number of participants” (p. 647) city dwellers tend to have more relational problems. In the case of ancient Israel, these relational problems were compounded by the kind of social order that emerged as a result of the process of urbanisation. In other words, city life undermined the social factors such as family bonds and community values that upheld and facilitated human relationships. According to Toy (1899), a proper description of ancient Israelite cities included the images of brisk commerce, feasts, gossips, temptations to licentiousness, relaxation of family-ties, worship of money, and close relations with royalty.

#### **Urban Life in Proverbs: Implication for Young Adults and their Relational Development**

Proverbial genre is mainly considered as a folk product (Mieder, 2004). This understanding extends to the book of Proverbs, but it is not an easy parallel to make. As Crenshaw (2000) puts it, “the greatest challenge facing scholars at the beginning of the twenty-first century is to describe the social setting of wisdom over the years” (p. 227). Two schools of thought have developed along this line; the elite/official camp



and the popular/tribal camp. The former pushes forward the view that the *sitz im leben* or social setting of Proverbs is the court of the king or the sages who were a professional group in the service of the king. Among the evidence provided are the association of the book of Proverbs to kings (such as Hezekiah and Solomon) and the nature of the sayings. Proponents of the latter argue that the social setting of proverbs is the family and the folk life of the people. The fact that the genre of proverbs is an oral tradition common to all cultures and the predominance of themes that reflect the life of ordinary people in Proverbs are some of the arguments they put up. Both sides have valid arguments for their position, but the problems arise when one has to choose one side over the other. There is no point in choosing, however, since there is the possibility that Proverbs contains the social setting of both the upper class or court life and the ordinary or popular background of its sayings. This is the position of scholars such as Aitken (2001) who argues that “Israel’s wisdom had many different strands to it and as many different spokesmen. It was, for example, equally at home in the pithy proverbs of the common folk, the moral and religious instruction of parents, the sagacious advice of the elders, and the political acumen of royal counsellors” (p. 2). What this means is that each saying or section should be evaluated on its own basis.

Interestingly, the main unit chosen for this study, Prov 1-9, has little controversy surrounding its *sitz im leben* (social setting). Several scholars share the view that the social setting revealed within its contents is mostly urban. Murphy (2002), for instance, writes of the instructions in Prov 1-9; “These instructions were produced among educated women and men belonging to the urban upper class of the Yehud province (p. 281). Toy (1899) equally supports the urban context of Prov 1-9 when he argues that the setting for this large pericope is to be located in the Persian and Greek period. In his interpretation of the activities of gangs as mention in Prov 1:10ff, Toy (1899) writes, “the organized robbery here referred to suggests city life of the later time, the periods when, under Persian and Greek rule, Jerusalem and Alexandria sheltered a miscellaneous population, and a distinct criminal class became more prominent” (p. 14).

#### ***Wisdom and Urban Life***

Having established that Prov 1-9 has urban settings, we now look at Proverbs as a wisdom genre and the implication of wisdom for urban living. Proverbs is the foundation of Old Testament wisdom books, which includes Job and Ecclesiastes (Childs, 1979). Wisdom is one of the traditions of ancient Israel which has survived alongside others such as the legal and prophetic traditions. However, wisdom is peculiar; unlike the others which show an overt commitment to the Yahwistic faith of ancient Israel, wisdom does not touch on any of the unique religious tenets of the Israelite people such as the promise to the patriarchs, the Exodus tradition, and the covenant at Sinai.

Proverbs, and by extension the wisdom corpus in the Old Testament, addresses itself to universal concerns of humans such as how to avoid temptation, how to speak, diligence, and friendship. Wisdom is about life, and not only that, but how one can maximise one’s life through proper formulation of character. In the opening of the book of Proverbs, wisdom emerges as a set of skills and competencies one masters as a necessary requirement to living. The remainder of the book shows that the individually acquired skills and knowledge are to be demonstrated within a community of others. Bland (2002) is of the view that wisdom primarily deals with how one lives in concert with others. He writes, “Wisdom is primarily relational. Thus, in order to find wisdom, individuals must not seek it primarily in solitude or private meditation, but in community with God and with other human beings” (Bland, 2002, p. 12). Ultimately, wisdom aims at promoting communal harmony by directing individuals to have the right conduct in society.

It is this goal of wisdom which makes it an important asset for urban living, especially for young adults. In the Old Testament, the city poses several challenges to its dwellers in maintaining *mišpat* (justice) and *tsedeqa* (righteousness); two qualities which promote harmony within society. It is not too surprising that biblical images of cities are tagged with negative descriptions of sin and oppression. For instance, the story of the Tower of Babel depicts the emergence of city as a human invention against God. Thus, right from the primeval times, urbanisation was a challenge to divine authority. Since city is of human origin, its character was a reflection of humanity’s imperfection. For Proverbs, then, City life demanded an attitude and character which positioned one to successfully deal with the temptations urban life presented.

#### ***Young Adults and their Relational Development in Proverbs***

Prov 1-9 is a unit for young adults. Its two main genres, the lectures and the interludes of wisdom poems, primarily target the young adult male. The former, which is the object of study, overtly and frequently uses the term **ben** (*son*) which can be construed here as a biological relationship between parents and their male child or the formal relationship between a teacher and his students. In any of these nuances, **ben** refers to a relatively young individual male who is matured enough to make informed decisions. Prudent decision making is what Prov 1-9 offers to the **ben** (*son*). Because of the complexity of urban life and the challenges it poses, Prov 1-9 simplifies life choices into the dyadic structure of the right path (the way of the wise) and the evil path (the way of the fool). In the process of teaching and directing the **ben** (*son*) towards the right path, Prov 1-9 alludes to several relationships that city life throws along the path of the **ben** (*son*). Among these relationships are peers/gangs, the parent, and God. Below, we explore how with wisdom the **ben** (*son*) can successfully negotiate through the complex web of relationships

which urban life offers.

**Parents:** The relationship between parents and their sons is one of the important bonds the Old Testament fervently promotes. Among the benefits fathers derived from this relationship is the continuation of his name by the son. Thus, the father is laded with several responsibilities towards the son including the instruction of the son in the Law and other norms of the society (cf. Ex. 13:14; Duet 11:19; Josh 4:6). Sons in turn were to honour their parents. In Prov 1-9, the relationship between parents (father and mother) and sons is captured in the form of instructions or lecture between the two. They appear in formulaic expressions such as:

Prov 1:8 *My son, hear the instruction of your father*

*And do not forsake the law of your mother*

Prov 2:1 *My son, if you receive my words,*

*And treasure my commands within you*

Prov 3:1 *My son, do not forget my law*

*But let your heart keep my commands.*

Parent-son relationship is fundamental to the progress and success of the **ben** (*son*). Through this relationship the parents transfer wisdom to the son. The parents are the epicenter for the wisdom the **ben** (*son*) needs. As Fox (2008) argues, the father emerges as an authoritative figure who seeks to direct the desires of the **ben** (*son*). The phrase **bēnī** (*my son*) highlights the bond between the two characters and makes the basis for which the **ben** (*son*) is to heed to the parents dependent on the established kinship bond. In Prov 4:3-9, the father alludes to the instructions he received from his father that is the grandfather of the **ben** (*son*). It is the relationship he, the father, had with his parents which enabled him to attain the wisdom he has now, and which he in turn gives to his son. From this argument, the father's concern is that the attainment of wisdom is partly dependent on the relationship children have with their parents.

Since parent-child relationship is so crucial for attaining wisdom, how does the father go about managing the relationship in order to achieve the goal of the son becoming wise? First, the father assumes an authoritative figure in his relationship with the son. He demands attention from the son. His rhetoric is filled with imperatives such as *hear* (1:8), *be attentive* (4:1), and *incline your ear* (5:1). Although he presents two alternatives, he offers his choice to the son and demands obedience from him. The son only has two choices: accepting the father's counsel in order to become wise or rejecting the father's counsel which leads to folly. Accordingly, the relationship is based on the authoritative presence of the father and the obedience of the son. I have argued elsewhere that the authoritative presence of the father can be explained against the backdrop that the father is instructing the son in virtue, an exercise which demands pedagogical strategies such as firmness (Okyere, 2013).

Second, the father develops his relationship with the son through intimacy and openness in their interaction. As a young

adult poised for adventure, the son faces numerous temptations, sometimes very overwhelming. Through intimacy and openness, the father paints a picture of life choices and their effects. He does not shy away from presenting the message in its raw and vivid character, lest the son misconstrue him as equally susceptible to these temptations. In Prov 6:25-29, for instance, the father speaks of the adulterous woman who tempts the **ben** (*son*) as follows:

25: *Lust not in your heart after her beauty*

*Let her not captivate you with her glance*

26: *For the price of a loose woman may be scarcely a loaf of bread*

*But if she is married, she is a trap for your precious life.*

27: *Can a man take fire to his bosom, and his garment not be burned?*

28: *Or can a man walk on live coals, and his feet not be scorched?*

29: *So with him who goes in to his neighbour's wife; non who touches her shall go unpunished.*

Fox (2008) argues that the father "speaks to the budding adult in a confidential tone, man-to-man, alerting him to the pull of greed, conformity, and above all, lust with a vividness that reveals his own nagging susceptibility to their call" (p. 350). Wisdom here lies in knowing the dangers or temptations in life and guarding against them.

**Friends (Gangs):** Proverbs promotes friendship. Good friends are compared to kinsmen (cf. 17:17; 27:9), as they never abandon the relationship. But Prov 1-9 is weary of the kind of friends the son could entangle himself with. Urban life throws all sorts of people into one's path: real danger abounds. The first lecture, Prov 1:8-19, gives insights into dangers of bad company that are often too common in urban centres. In vv. 11-14, a gang throws an invitation to the **ben** (*son*) to join them. Careful analysis of their invitation reveals the level of danger young people face. The unit reads as below:

11 If they say, "*Come along with us; let us lie in wait to for blood, let us wantonly ambush the innocent;*

12 *like sheol, let us swallow them alive and whole, like those who go down to the pit;*

13 *we shall find all precious goods, we shall fill our houses with spoils;*

14 *throw in your lot with us, we will all have one purse"*

The phrase, **lēkāh 'itānū** (*come along with us*), reveals a sense of power on the part of the gang over the **ben** (*son*). As an imperative, the phrase is not only indicative of the opposition the gang offers to the authority of the father, but also the promise of peer fellowship with all its attendant benefits. Three prizes are hurled towards the **ben** (*son*) as basis for joining the gang: that is adventure (v.11), easy money (v.13), and camaraderie (v.14).

Adventure provides young people avenue to express their energy and showcase their potentials. In this instance, the adventure promised includes the careful act of laying an ambush, waiting patiently for a victim to come along, and pouncing on the victim to inflict pain and to ultimately kill the victim. Such exuberance and thoughtful planning is to lead to easy money. Herein lies the difficulty in understanding the gang, since the members do not lack the power or means to earn money rightly. Rather it is a matter of choice: a way of life they have chosen. That explains why the father admonishes the son as follows; *'al tēlēk bēderek 'itām* (*do not walk in the way with them* – v. 15). In other words, the son should not take along this kind of life. However, the gang offers an even greater prize of companionship. According to Newsom (1989), implicit within the offers of the gang is an egalitarian ethos. By throwing in his lot, the **ben** (*son*) ties his fate to the rest of the members. In addition, Fox (2008) points out that the phrase, **gōrālkā tapīl** (*cast in your lot*), has a double semantic function: apart from the meaning of tying of fates together, there is also that of uniting their booty to share equally. Few young people can withstand such alluring invitations from peers.

Although friendship is healthy and can improve one's life, the kind of friends one chooses has an influence on one's thought and actions. Since young people rage with so much ideas and energy they easily become vulnerable, especially to peer pressure. Urban life compounds their vulnerability by accentuating the forces that pull them to surrender their will. As a result, approval of peers and group acceptance become an important choice for many young adults who do not want to be regarded by the peers as weak and unadventurous.

**Partner (Wife) vs "Strange Woman"**: Proverbs points out the dangers urban life poses to the relationship that exists between couples. The **ben** (*son*) who is just married or about to marry is cautioned against the dangers of illicit and amorous relationships (Prov. 5:1-23; 6:20-35; 7:1-27). The focus of the warning is on the **zārāh** that is "strange woman". Who is this "strange woman". Several proposals have been put forward by scholars on the identity of this woman. Perdue (2000, p. 118) sums it up when he writes, "this enigmatic figure appears to include a variety of identities: a prostitute, a fertility priestess, an adulteress, a worshiper of a fertility goddess, and folly". However, the explanation given by Bland is preferable here. For Bland (2002) the "strange woman" is another man's wife. Her strangeness stems from the fact that she is not supposed to be "known" by other men. In Prov 7:19, the "strange woman" speaks of the absence of her husband. Seduction is the main danger posed by this "strange woman".

The first time we meet the "strange woman" is in Prov 2:16. She emerges as a smooth talker, who has the power to dazzle her victims. In her second appearance in Prov 5:3, she persists in her smooth talk as her words are likened to honey. Speech emerges

as an important strategy for the strange woman to lure her victims. Her characterisation reaches its peak in Prov 7. Two words depict her inner disposition: **homiyyāh** (*loud*) and **soreret** (*stubborn*) (Waltke, 2004). The former portrays her constant movement with the goal of being visible. She is not afraid to be seen and heard. Her description as **soreret** (*stubborn*) or defiant ties into her incessant and noisy movement on the street. Her inner restlessness leads to outer display of defiance. The concluding part of v. 11 reads, **bēbētāh lo'-yiškēnū raglēhā** meaning "her feet does not stay in the home". This woman acts in desperation for something she believes is located outside her home. In v. 13, her actions crown her desperations as she seizes the young man and kisses him without any sense of shame or sensitivity to public scrutiny. She yearns for a sexual encounter with the young man. One may argue that her desperation for sexual union with the young man stems from the absence of that encounter in her home. But this argument is made weak by the observation that the woman continuously seeks out young boys in the street, an action which informs us of her insatiable quest for sexual pleasure.

In order for the **ben** (*son*) to understand the danger she poses, a litany of the negative effects of associating with her is outlined. Beginning is the loss of one's value which in Prov 5:9-10 are presented as **hōdekā** (*your honour*), **šēnotēkā** (*your years*), **koḥekā** (*your strength*), and **'āšābekā** (*your labours*). There is also the health risk captured in the phrase **biklōt bēšārkā ušē'erekā** (*when your flesh and body are consumed* – 5:11). Fox (2008) suggests that venereal disease might be the case here, especially when the disease of Gonorrhoea is alluded to in Lev 15:1-15. Social and physical negative effects culminate finally in the death of the young man (cf. 2:18-19; 7:22-23). If the **ben** (*son*) cherishes his life, if he yearns to have a full life, then one sure thing to do is to avoid the strange woman that is completely bar any thoughts of establishing a relationship with her.

Admonished to avoid the strange woman, the **ben** (*son*) is urged to take comfort in the wife. Unlike the strange woman, who poses danger and may lead to one's death, the wife is a fountain of life goodies for the young man. In Prov 5, the wife emerges as the best solution to the dangers posed by the strange woman. If it is sexual pleaser the young man is after, the wife is the best person to offer that. The increased challenge posed by the adulteress or the "strange woman" urges the father to strengthen his rhetoric with penetrating images to convince the **ben** (*son*) of the need to be loyal to the wife. For instance, the wife is compared to *loving doe* – **'ayelet 'āhābīm** who is ever ready to offer her comforting breast (v. 19). Sexual pleasure is likened to the *well* or a *cistern* (**bōr**), and the **ben** (*son*) is encouraged to drink from his own well. Indeed, the climax of the father's message to the son is captured in the second part of v. 18 which reads; **ūšēmah mē'set nē'ūrekā** (*and rejoice in the wife of your*

youth). Not only are the values of commitment and faithfulness key to successful relationships, but also genuine interests to enjoy one another. Although it appears the emphasis is on the son to be the active agent in securing the relationship, the wife is presented as ever ready to meet the demands of the husband. She yearns and seeks her husband's embrace (5: 18-19). Husband and wife are to meet each other's sensual needs in their journey of life. An open expression of their love should break barriers and bind the two in a manner which leaves no room for intruders such as the "strange woman".

**God:** As a traditional society, ancient Israel was a religious community. Belief in God as the creator and sustainer of the world was a fundamental knowledge that no person could challenge. When the psalms talk of persons who say in their heart "there is no God", it is not an issue of atheism that is being raised. Rather, the psalmist is referring to people who know the existence of God, but disregard its implication by ordering their life in a manner which displeases God (Okyere, 2016). The belief in God in ancient Israel is comparable to the Akan society where recognition of God's existence is a given, hence the saying "obi nkyere abofra nyame" (no one teaches a child that there is God).

Proverbs elevates relationship with God as fundamental to attaining wisdom. This clearly stands out in what many perceive to be the thesis of the entire book, **yira't yēhwāh rē'šīt dā'at-hākmāh** (the fear of the Lord is the beginning of wisdom – 1:7a). Waltke (2004) explains that the phrase **yira't yēhwāh** (fear of the Lord) has two poles of meaning: a rational and a non-rational pole. Rationally, the term is synonymous to "law" or "statutes" or "commands" of the Lord. Whybray (1965) explains further by stating that the phrase refers "to a standard of moral conduct known and accepted by men in general" (p. 96). By fearing the Lord, one is motivated to rightful behaviour. Non-rationally, the fear of the Lord ignites emotional response of fear and trust in the creator. It is an emotional response that leads one to seek diligently the will of his or her creator.

For Bland (2002), *the fear of the Lord* begins with godly living. It is gained by practicing what is right, just, and fair. Thus one's fear of the Lord leads to one's observances of his statutes. Core to the statutes is how an individual ordered his or her life to maintain social harmony. Deuteronomy explicitly explains what it means to fear the Lord in 10:12-13 as follows:

*And now, O Israel, what does the LORD your God ask of you but to fear the LORD your God, to walk in all his ways, to love him, to serve the LORD your God with all your heart and with all your soul, and to observe the LORD's commands and decrees that I am giving you today for your own good?*

God is a relational being who yearns for his people to love him through their observance of the law. An examination of the law shows that it is rooted in establishing good relationships

among people within the community. God's law prevents injustices, seeks to liberate the poor, protect the vulnerable and ensure parity in social and economic relationships. By taking the path that embodies these values, the young adult affirms his relationship with God.

A relationship with God, which is characterized by *the fear of the Lord*, leads to several benefits for the young adult in the city. One such benefit is prudence (Prov 1:3). The Hebrew word for prudence is **maskîl**; its root is **śekel**. According to Fox, **śekel** refers to "insight," the ability to grasp the meanings or implications of a situation or message. **Śekel** is consequently discernment or prudence, the ability to understand practical matters and interpersonal relations and make beneficial decisions. It later comes to include intellectual understanding and unusual expertise. The temptations of city life which Toy explains as "the urban crimes of perjury, theft, robbery, and murder" demanded strong personalities, who having attained the quality of wisdom, will know what to do in any given situation.

Relationship with God also gives the **ben** (son) a sense of hope and optimism. For instance, Prov 3:5-6 reads

*5 Trust in the Lord with all your heart,  
and do not rely on your own understanding;  
6 in all your ways desire his presence,  
and he will make your paths straight and smooth.*

Optimistic individuals are hopeful (Bruiniks & Malle, 2005). They believe that no matter the situation they find themselves in they live in "the best of all possible worlds". Their positive approach to life predisposes them to appropriate actions for change. Several studies indicate that hope and optimism are essential elements in attaining mental health within the fast moving urban life. Believe and trust in God or a transcendental being positions one with the understanding that positive events will occur frequently in their lives than negative ones because they have a greater being who looks out for their wellbeing. Thus Prov 3:26 reads, "for the Lord will be your confidence and will keep your foot from being caught." Such reassurance is a welcome news to young city dwellers who may be struggling to make sense of the hustle and bustle of life.

Also implicit in Prov 3 is the need for the **ben** (son) to have time and seek the presence of God and reflect on its implication for his life. A relationship with God involves the conscious effort on one's part to know God. In Prov 2:4, knowing the fear of God and his knowledge requires seeking it. The Hebrew word for seek is **bāqaš**. It connotes the ideas of searching and desiring. Thus the subject engages in a purposeful activity to connect with something or someone. In this context, the object desired for is God. The **ben** (son) in Prov 3 is encouraged to channel part of his energy in seeking or searching for God and his knowledge. Indeed, such habits on the part of young adults today could help them loosen up as they take a break from secular life and the

stress of urban life, and devote some time for spiritual exercises.

#### **Implications for the Ghanaian Society**

The world of Proverbs is the kind in which temptations abound. There exist gangs who lure young ones to join their fold in order to commit all sorts of vices. Prowling the streets are women who want to prey on young adults. Families bonds are stretched and broken sometimes. In these circumstances, relationships matter, especially to young people. It shapes their identity and determines the trajectory of their lives. For the book of Proverbs, the only way to deal with the temptation urban life offers is to attain wisdom. Wisdom is an attitude and approach to life; it disposes one in a manner that makes him or her navigate through the challenges unscathed. Although ancient Israel and the Ghanaian society are historically separated by thousands of years, there are many common grounds between the two societies. As Mumford (1961) argues, there is continuity in the character of ancient cities and contemporary urban structures. Thus, many of the challenges that confronted ancient dwellers of cities continue to persist in modern times, including Ghana. In what follows, we explore the implication of the above discussion for the Ghanaian society.

**Helping Young People Understand Their Choices:** One important observation in the lectures of Proverbs is the continuous effort on the part of the father to direct the path of his son. The father does not take for granted the idea that his son is old enough to make his own choices. Indeed, the very reason why the father is preoccupied with the son's life is because of the status of the son as a free independent person who makes his own decisions. The **ben (son)** makes his decisions and bears the consequence of his decisions. Thus, the father's intervention is aimed at helping the **ben (son)** to have a proper understanding of what lies out there. This intervention of the father in the life of his adult son is not a strange concept among many traditional societies in Ghana. The Ghanaian anthropological landscape shows that a child continues to be a "child" of the parents irrespective of age and status.

Transporting this portrait of parental intervention in the lives of their adult children will meet resistance in the current social context of many Ghanaians, especially for young people living in urban centres. As Macmillan (2007) argues, the sense of independence is an important determiner of adulthood for young people. However, the import of the biblical portrait lies in the position that some level of assistance for young adults is important in helping them in their decision making. In other words, for Proverbs, advent of adulthood does not mean one is all knowing to the extent of being immune from counsel. The underlying principle here is that young people need to be continuously guided in their choices as they become more independent and lead their own lives. Such guidance need not necessarily come from parents. Various stakeholders such as the

church, Non-governmental organisations (NGOs), and other social centres can play constructive roles in this respect.

**Maintaining Family Bonds:** Family connections should be maintained even when young people believe they are matured enough to chart their own path. In the lectures of Prov 1-9, the father and mother are the fountain of wisdom for the **ben (son)**. Just as the father received wisdom from the son's grandfather, so he passes it onto the **ben (son)**. There is the implicit message of the need for the **ben (son)** to pass on the wisdom to his own children. As a result, wisdom becomes a family tradition, which creates an identity for the family as well as shapes the fate of family members. By maintaining healthy relationship with the son, the father contributes to the security and development of the son. The father's rhetoric shows that a healthy bond exist between parent and child; so intimate that he could speak frankly and openly with his **ben (son)**.

Such healthy relationship between father and son or parents and their wards is increasingly becoming rare among urban settlers, including those in Ghana. Because family members may not be living close to each other, unlike the village setting, contacts are reduced, leading to weaker and less committed family relationships. Many families are making up for this inadequacy through the use of social media such as Whatsapp. These developments are good and need to be encouraged since family bonds are one of the fulfilling and purposeful group individuals can identify with.

**Reducing Exposure to Violence and Social Vices:** Although there are positive images of urban life in the Old Testament, largely, a picture of judgment and condemnation characterizes urban life. Proverbs is no exception to this, as concentration of sin/crimes is one of the images prevalent in the lives of city dwellers. Because of their inexperience and continuous definition of their identities, young people sometimes become easily vulnerable to bad companies and friends. In Proverbs, the sages dwell on the personality of the young adult to overcome the challenges posed by bad companies in the city centres. As much as dwelling on the character and personalities of young adults could reap some results, the source of the problem that is the presence of these bad companies remains unchecked. A vital component of policy formation on cities should aim at tackling the sprawling of gangs and other anti-social groups which entice young people to join their fold.

**Promoting Spirituality among Young People:** Proverbs posits that young adults are better positioned to enjoy life when they inculcate religion or spirituality into their lives. Establishing good relationship with their creator (God) could lead to hope and optimism on the part of young adults. Right attitude becomes the concern of young adults as they order their lives in a way that pleases their object of worship. Many studies confirm the importance of spirituality for one's development and wellbeing (cf. Daaleman & Frey, 2004; Fehring, Brennan, & Keller, 1987).

In Ghana, religion is very much integrated into the fabric of daily life. Churches abound and mosques are also increasing. It is therefore safe to conclude that majority of Ghanaians are religious. However, there is increasing concern that the religious nature of the society does not translate into right attitude and behaviour of Ghanaians. There is a disconnect between the attitude and behaviour of Ghanaians on one hand and their religiousness on the other hand. Some, therefore, are of the view that religion is failing to affect the society positively.

Proverbs proposes that young adults establish a relationship with their God. In other words, young people should develop spirituality (where spirituality means a personal relationship with one's object of worship as opposed to religion which is institutionalized and formal). This is not to say young people should not be part of a religious institution or tradition. Rather, they should move beyond the mere association with a religious tradition to a personal commitment to their object of worship. Personal relationship with one's deity has the ability to effect far reaching changes in the lives of young people. They conceive themselves as having a larger purpose in life. Ghanaian cities can help young people in this respect through the provision of spaces and places where the environment promotes relaxation and reflection. Such spaces and places can be exploited for spiritual exercises of reflection and contemplation. This way, young people will be spending their time productively as they reflect on their lives in relation to their beliefs system.

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# Urbanization and Informal Land Use in Nigeria, Africa

*Musibau Jelili<sup>a</sup> & David Ogunkan<sup>b</sup>*

(a. Department of Urban and Regional Planning, Ladoke Akintola University of Technology, (LAUTECH), Nigeria;

b. Department of Urban and Regional Planning, Bells University, Nigeria)

**Abstract:** Against the background that land use and urbanization in Africa is much informal in nature, this paper attempts to model the informality question in African urbanization process from urban (land use) planner's perspective. It starts by exploring the construct of informal land use (ILU) and various dimensions of informality as essential ingredients of understanding informal urbanization process on the continent. With primary data on land use, socioeconomic, and related variables from selected capital and noncapital cities of Ilorin and Ogbomoso (Nigeria) respectively, as case study, a model for predicting the incidence of ILU to be generated given certain neighbourhood conditions was developed and used for necessary simulation. The paper concludes that ILU or informality component of urban land use and development can be understood, predicted, formalized and incorporated into the planning of urban land use, development and/or urbanization process. It however recommends further similar empirical research endeavours to cover other parts of Nigeria and Africa, as well as more inclusive policy measures in favour of informality, which is rapidly becoming the mainstream of the average African economy.

**Key words:** Informal Land Use, Urban Development Planning, Integration Framework

## Introduction

Urbanization is one of the most dramatic global social transformations of the 21st century. Currently, over half (54%) of the world's population reside in cities. This urbanization trend is expected to continue and about two-thirds (66%) of the world's population is expected to live in cities by 2050 (UN-HABITAT, 2010, 2016). Evidences in the extant literature have proved that Africa is urbanizing rapidly. Its rate increased from 15% in 1960 to 40% in 2010, approximately 42% in 2012 and is projected to reach 55-60% in 2050 (UNESA, 2014). It has experienced highest urban growth rate during the last two decades at 3.5% per year (ADB, 2015).

These regularly and widely circulated human population and urbanization data for African countries by such sources as World Bank and UN-Habitat may, though, be a subject of debate (Potts, 2012), the increasing urbanization of African communities is an established phenomenon. That this absolute increase in human population and its attendant increasing urbanization level shall be more in magnitude and more devastating in consequence in developing economies particularly African countries than in the developed world, is also an established phenomenon in the literature (Pieterse, 2010; Jelili, 2012). One of the most challenging issues is the fact that, rather than serving as engines of growth, cities in Africa, and perhaps

other developing economies are sights of all forms of nuisance, resulting from such problems as environmental management, urban pollution, poor sanitation, inadequate and substandard housing, inefficient transportation systems, overstressed infrastructure, and urban crimes, among several others, all of which are directly or indirectly related to the level, type or lack of planning and management of urban development. A particular feature, which has made the planning and management of development activities in most African communities difficult, is informal urbanism, while the process may be described as informal urbanization. This perhaps informed the decision of the Association of African Planning Schools (AAPS) in 2010 and UN-habitat-established network, Habitat University Network Initiative (UNI) at its Global Meeting at the University of South Florida, Tampa, USA in 2013, to prioritize "Informality" and "Informal Urbanization" respectively as one of the thematic areas, to which members of the international association and network are encouraged to direct their research attention (AAPS, 2010 and HPUI, 2013).

It was against the above background that this study, which was informed by these two different institutional initiatives, attempted to investigate issues surrounding informal urbanization, and more importantly how to incorporate informality question into formal land use and urban development planning process. With a particular emphasis on Nigeria

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**Author:** Dr Musibau Jelili is a Reader and former Head of Department of Urban and Regional Planning, LAUTECH. With a B.Tech, M.Tech and PhD in Urban and Regional Planning, plus professional qualification and many publications, he has a vast experience in teaching, research and practice of urban planning and related areas.

Dr David Ogunkan is a Lecturer at Bells University, Nigeria. He holds a Bsc in Sociology, M.Tech and PhD in Urban and Regional Planning. He is a member of the Nigerian Institute of Town Planners and a Chartered Town Planner, with adequate planning practice experience and many publications.



situation, the study took off with an exploration of informal urbanization issues, including theoretical perspectives and dimensions of informality and attempted a case study approach to analyzing the issues surrounding informal land use and/or human activities in two Nigerian cities. This shall be part of efforts towards achieving sustainable development goals 1,2,3, and 8 which talk about eradication of poverty, hunger (which may be the reason for the spread of informal activities and/or land use) as well as issues pertaining to healthy living, sustained, inclusive and sustainable economic growth, in African region.

### Literature Review

Informality in African cities or urbanization process is assuming a phenomenal dimension and fast expanding. It is now gaining the attention of researchers, development analysts, government officials and international agencies and associations, as well as prompting a massive profusion of literature (ILO, 2002, Chen, 2007). However, most of these studies and efforts were hinged on the controversial conception of informality as envisioned by Hart (1973) principally to describe a variety of forms of employment or economic activities mainly on the fringes of the organised or 'modern' part of the economy and sometimes technically illegal. Therefore, whenever the phrase 'informality' comes up in the literature, it is often linked to businesses not amenable to official regulation. As a result, most studies on informality in Africa have a myopic conception of informality as solely an economic phenomenon. Such studies focussed only on the economic dimension (Ademu, 2006; Akintoye, 2008; Arimah, 2001; Ogunkan et al, 2015) but ignored other aspects of informality, particularly land use.

Although, some other studies have attempted to go beyond the purview of economic dimension of informality to include other properties of informality such as informal housing and settlements (Agbola and Jinadu, 1997; Ikejiofor, 2006; Egbu et al, 2008; Ogunkan and Adeboyejo, 2015), informal transportation, informal waste management (Agunwamba, 1998; Adama, 2007; Afon, 2007) among other sub-categories of informality. However, the recommendations that emanated from these studies were atomistic. There is, therefore, an obvious need for holistic research on African informality to cover a wide range of informality elements that will provide the feedbacks necessary to avert a slide of informality research into "ritual academic blind alleys" (Flyvbjerg, 2004). Such studies must view informality as "much more than an economic sector" but also a mode of production of space (Roy, 2003). It is, therefore, apposite to talk of informality in Africa as "system of informality" (Roy, 2003), which is best captured according to Watson (2009)'s conceptualisation of informality as encompassing "forms of income generation, forms of settlement and housing, and forms of negotiating life in the city". All these may be spatially expressed as informal land use, which is an

emerging concept in the literature of urban planning, urban studies, urban management and related fields. There have not been adequate empirical studies to reaffirm relevant postulates and inform policy directions in this regard. This has been a research gap in urban studies for some time now. Notable in the extant literature in this area is the work of Onyebueke and Geyer (2011), but their analysis and recommendations were based on article synthesis rather than empirical analysis of the phenomenon. Such empirical studies, which are being exemplified here, may be geared towards providing answers to such questions as: what are the magnitude and various dimensions of informality in Africa communities? What are the factors affecting informality and/or informal urbanization in Africa? How do we integrate informality issue into urban land use planning? These, among others, constituted the focus of this study, which culminated into what is described here as an urban planner's model of integrating informality or informal land use into the formal land use and development planning.

### Theoretical and Conceptual Perspectives

#### *Theoretical Perspectives of Informality*

The informality literature is vast. There is a multitude of conceptualisations and definitions (Guha-Khasnobis, et al, 2006). This perhaps has sparked off many theoretical perspectives on the causes, nature and composition of informality. However, the four contrasting frames dominate the current discussion of informality. As such, the debate on informality has crystallized into four dominant schools of thought. These include the dualist, structuralist, legalist and voluntarist schools of thought.

The dualist perspective views the formal and informal sectors as having almost no links with each other and in theory represent almost two opposite parts of the economy (Ndhlovu, 2011). The Dualists subscribe to the notion that informal units and activities have a few (if any) linkages to the formal economy but, rather, operate as a distinct separate sector of the economy and that the informal workforce—assumed to be largely self-employed—comprise the less advantaged sector of a dualistic or segmented labour market (Chen, 2012). This school of thought links the persistence of informal activities to insufficient formal job opportunities as a result of a slow rate of economic development and a faster rate of urbanization (Tokman 1978). Therefore, the theorists working within this, The Dualist school, sees the informal sector of the economy as comprising marginal activities—distinct from and not related to the formal sector—that provide income for the poor and a safety net in times of crisis (Hart 1973; ILO 1972; Sethuraman 1976; Tokman 1978). They argue that informal operators are excluded from modern economic opportunities due to imbalances between the growth rates of the population and of modern industrial employment, and a mismatch between people's skills and the structure of modern economic opportunities.

In a swift response to the dualists' sentiment, there emerged the structuralist understanding of informality. The structuralists' view is at variance with the dualism argument of the economic system and emphasises the way in which forms of production, productive units, technologies, and workers are integrated into various parts of the economy (Rakowski 1994: 503). Based on their units of analysis, the structuralists assert that both the formal and informal economies are intrinsically linked. They argue that there are evidences of informality in formal enterprises. For instance, several formal enterprises employ wage workers under informal employment such as part time workers, temporary workers and home workers who were employed in formal enterprises through contracting or sub-contracting arrangements. The structuralists argue that the nature of capitalism/capitalist growth drives informality. Specifically, the attempts by formal firms to reduce labour costs and increase competitiveness and the reaction of formal firms to the power of organized labour, state regulation of the economy (notably, taxes and social legislation); to global competition; and to the process of industrialization (notably, off-shore industries, subcontracting chains, and flexible specialization) (Chen, 2012). They see both informal enterprises and informal wage workers as subordinated to the interests of capitalist development, providing cheap goods and services (Moser, 1978; Portes et al, 1989). They are of the opinion that governments should address the unequal relationship between "big businesses" and subordinated producers and workers by regulating both commercial and employment relationships (Chen, 2012)

The legalist school of thought on informality was led by economist Hernando De Soto who focuses on entrepreneurs and institutional constraints that make informality a rational economic strategy. The legalists attribute the growth of informal enterprises to the strict rules and regulation, taxes, time and effort involved in complying with formal state procedures (De Soto, 1989). The legalist school sees the informal sector as comprising "plucky" micro-entrepreneurs who choose to operate informally in order to avoid the costs, time and effort of formal registration and who need property rights to convert their assets into legally recognized assets (De Soto 1989, 2000). They, therefore, blame the rise of informality phenomenon to excessive state regulation and not to the dynamics of labour market. The legalists see informality as radical breaking of legal barrier, a natural response to real market forces, and not to the rise in unemployment and the need for jobs. The Legalists focus on informal enterprises and the formal regulatory environment to the relative neglect of informal wage workers and the formal economy per se. Even at this, they acknowledge that formal firms — what De Soto calls "mercantilist" interests — collude with government to set the bureaucratic "rules of the game" (De Soto 1989). They argue that governments should introduce simplified bureaucratic procedures to encourage informal

enterprises to register and extend legal property rights for the assets held by informal operators in order to unleash their productive potential and convert their assets into real capital.

Both the legalists and the voluntarists share somewhat related opinion in that informal entrepreneurs deliberately seek to avoid regulations and taxation but unlike the legalist, the voluntarists do not blame the cumbersome registration procedures. Rather, the voluntarists argue that informal operators choose to operate informally—after weighing the costs-benefits of informality relative to formality (Chen, 2012). Yet, unlike the structuralist school, the voluntarists pay relatively little attention to the economic linkages between informal enterprises and formal firms but subscribe to the notion that informal enterprises create unfair competition for formal enterprises because they avoid formal regulations, taxes, and other costs of production. They argue that informal enterprises should be brought under the formal regulatory environment in order to increase the tax base and reduce the unfair competition to formal businesses.

Be that as it may, the exclusion of the informal operators in the scheme of things may lead to their looking for a less acceptable form of eking out a living, and the negative implication for environmental sustainability, which calls for the concern of different categories of stakeholders in urban management. More so, all the views above (dualist, structuralist, legalist and voluntarist) have one thing in common – they all express economic perspective of informality. In other words, they all see informality in the context of informal economy or informal sector activities. While the views help in understanding the factors of informality, balancing the analysis with the spatial expression and other dimensions of the phenomenon will help a lot in devising ways of integrating the phenomenon into the formal urban economy, land use and development planning. This is a gap that needs be filled in the existing body of knowledge that can inform appropriate policy decisions, and it has necessitated the conceptual clarification in the following section.

#### ***Conceptual Framework***

The concept of informality is not so popular in the literature, even though it is usually used unconsciously to refer to illegality, 'unofficiality', lack of planning, irregularity, inconsistency, state of not covered by legislation, state of not being accounted for, state of not following any laid down rules, etc. In other words, informal events, activities, or spaces are easier identified than defined. However, the general usage and issues surrounding informality suggest such terminologies as: informal land use, informal housing, settlement or urbanization, and informal economy, which are not so mutually exclusive, but interwoven.

**Informal Land Use:** The informal land use is a construct used to capture all human activities including petty trading, mini-market, restaurant, beer palour and related commercial activities, cottage industries like blacksmithing, cassava flour processing, carpentry/ furniture works, grain milling, shoe

mending, cloth weaving, road-side printing, and soap-making, and service industries like road-side mechanics, panel-beating, welding/metal works, tailoring, vulcanizing, barbing and indiscriminate commercial motor-cycle parks, among others, in the less organized private sector. Informal land use refers to all land use activities that “thrive in their thousands in the cities of the less developed countries, transforming them into beehives of minuscule enterprises all of which are pitched in stiff competition for dwindling space and patronage” (UNDP,1996). While each of these activities may belong to one or other category of traditional land uses – residential, commercial, and industrial, among others – the conventional land use planning rarely accommodates them to co-exist with similar uses in harmony.

**Informal Housing/Settlement:** Informal housing refers to any form of housing that evades all or one form of control and documentation or the other, including physical development, title registration, taxation, etc. It also includes unauthorized buildings, makeshifts and other forms of squatter settlements. While most of the rural housing are informal, the term informal settlement is usually used to describe an urban neighbourhood with a larger percentage of such informal housing than the formal one. The informal settlement is thus homes of the poverty-ridden, unemployed or underemployed urban dwellers, particularly migrants who provide cheap, unskilled and semi-skilled labour, most of whom are ‘faceless’ and very mobile urban dwellers, who have little or no value for cultural ties.

**Informal Economy:** Informal economy is a terminology used to capture all economic activities outside the formally recognized or registered and properly controlled sectors of the economy, which are not captured in such economic measures as taxation and gross domestic product (GDP). The spatial dimension of their activities is described as informal land use. Because of its evolving popularity in political economics, issues surrounding informal economy have generated arguments and counter arguments of different schools of thought examined earlier.

**Informal Urbanization:** Urbanization is described basically as increasing agglomeration of human population and/or activities in a growing settlement. Informal urbanization, therefore refers to the process of increasing human population, activities and uncontrolled spatial expansion of settlement, triggered and characterised basically by increasing number and quantum of less regulated physical development, economic and industrial activities.

It is important to note that there are a lot of interconnections between the various dimensions highlighted above. While the informal economy refers to the various activities of the informal sector of the economy, the factor of poverty, which necessitates the springing up of the activities, where they are, and the poor mobility of the operators encourages the emergence of informal

housing or squatter settlements. The spatial expression of them all is conceptualised here as informal land use, while the process of increasing magnitude of the entire phenomenon is called informal urbanization.

### **Methodology**

The study was designed to be a quantitative analysis of the problem of informality. It analyzed the situation of informal land use in Nigeria with a case study of two cities (a capital and a non-capital city) where an in-depth study of the land use and how to integrate same into formal land use planning process was established. The choice of the two cities was informed by the need to capture the capital-noncapital, north-south, and well-and-moderately- urban dichotomies represented by Ilorin and Ogbomoso respectively.

#### ***Data Sources and Collection Techniques***

Apart from the secondary data, which included human population, urbanization levels and rates, among others, the study benefitted mainly from primary data. The primary data were of two main categories. The first category was land use data obtained from observations and recordings (using a recording format prepared for the purpose) by trained research assistants along transport corridors selected purposively across different segments, residential and other land use areas of the two cities of Ilorin (capital) and Ogbomoso (non-capital), Nigeria. The recording format is a table with the first column indicating the number of investigating units, with each unit covering a distance between one electric pole and the third one, and the other columns for land use variables as indicated below.

The other category was socio-economic-cum-cultural characteristics data, obtained through questionnaire administration, using random systematic sampling (along same transport corridors as for land use data) in which a total of 400 respondents who were household heads (202 and 198 from Ilorin and Ogbomoso respectively) were covered.

The survey adopted the distance between one electric pole and the third one as a unit of investigation at which pieces of information on such variables as: (1) informal land use component, (2) the predominant land use type, (3) land use mix, and (4) land use intensity, among others, were (measured as shown 4.2 below) obtained to cover not less than a half of both sides of the two selected roads, which cut across different segments of the cities. With this, a total of 301 investigating units (136 and 165 in Ogbomoso and Ilorin respectively) were covered.

#### ***Treatment/ Operationalization of Variables***

The informal land use was made to cover all space-occupying business activities in the sector (as discussed earlier). This was measured through a surrogate measure or index - incidence of informal land use (IILU). The index is a land use variable, which is obtained by assigning weight scores

of 5 to a floor, 3 to a plot not built on but used for informal activity(ies), 2 to a shop, 1 to a kiosk, and  $\frac{1}{2}$  to a counter or a related structure, depending on the number of the floor(s), plot(s), shop(s) and kiosk(s), etc at each investigating unit. That is, the IILU is the sum of the products of the weight scores of the different activity-spaces and their numbers at each investigating unit. This gave rise to a ratio data which was amenable to both parametric and non-parametric tests.

Land use intensity (LUI) is a density index which measures the quantum of physical development per plot of about 450 square metres. It was measured by assigning weights of 5 to a floor, 3 to a shop/container, 2 to a kiosk and 1 to a counter or similar structure. That is, the LUI is the sum of products of the weight scores assigned to different forms of physical development and their numbers at each investigating unit. This also gave rise to a ratio data which was amenable to both parametric and non-parametric tests.

Land use mix is defined as the mixture or combination of uses that co-exist either legally or illegally within each investigating unit. It was measured simply by considering the number of uses identifiable within each investigating unit. This was also a ratio data

The predominant land use type is that which occupies the largest proportion of space, as adjudged by the expert observer. It should be noted that this is a nominal independent variable whose relationship with the dependent ratio variable IILU is analyzed with ANOVA.

Socio-economic and other related variables used include: (1) level of participation in informal activities (defined as the percentage of people who are engaged in the informal activity as their major occupations divided by the percentage of those whose major occupations are not in the informal sector), (2) age, (3) income, (4) major occupation, (5) gender, (6) nativity, (7) employment status, (8) education, and (9) length of residency, all were measured directly as interval/ratio data, where possible, or converted to percentages or other ratios and means in some cases, to make them ratio data and amenable to parametric model of linear regression analysis detailed below.

#### **Data Analysis**

The land use and socio-cultural variables were first factor-analyzed (using principal component variant) to reduce the long list of sixteen variables into an understandable set of five components as dependent variables or factors which were later fed into a multiple regression model with the incidence of informal land use IILU as dependent variable. This was used to explain the effects of certain land use and socio-economic-cultural variables on the incidence of informal land use (IILU) in a neighbourhood, and also used to make cases for the spatial performances of informal land use given certain conditions of other land use and socio-cultural parameters, through some simulation processes.

The regression model is presented mathematically as:

$$y = a + b_1x_1 + b_2x_2 + b_3x_3 + \dots + b_5x_5 + e$$

Where:

y = Incidence of Informal Land Use, IILU (Dependent variable),  $x_1 - x_5$  = component 1, component 2 component 3, component 4 and component 5

The data were appropriate for regression analysis in that: (1) the dependent variable, y, was measured as ratio data, while the independent variables  $x_1 - x_5$  were standardized to make them usable as ratio data; (2) the number of cases involved was large enough (400) to possess the characteristics similar to those of the normal distribution; and (3) the relationship between the dependent variable and the emerged components (independent variables) is linear ( $R = 0.878$ ); and (4) multicollinearity was prevented as the emerged components were truly independent as there was no case of a significant relationship between any two of them.

The model was in addition to analysis of variance (F-test) and Chi-square where necessary to test some relationships between and involving certain nominal variables.

#### **Findings and Discussion**

This section attempts to analyze the contributions of certain land use types to IILU and takes a step further to developing a model capable of explaining the process of integrating the informal land use to the formal land use planning in Nigerian and similar other cities in Africa.

##### **Types and Distribution of Informal Land Use (ILU)**

Five broad categories of ILU were identified. These include trading of different kinds, small-scale services, automobile artisans, cottage industries, and others that are difficult to put under any of the categories. Overall, trading constitutes the majority (59.5%) of the ILU. With 59.4% and 59.6% of the category in Ilorin and Ogbomoso respectively, the situation is about the same in the two cities. This is followed by small-scale services, automobile artisans and cottage industries in that order with a proportion each of 25.3%, 7.8% and 3.5% respectively. There are however significant inter-city variations in the distribution of these three categories of ILU. For example, while the proportions for service providers and artisans in Ilorin are 19.3 and 10.9 respectively, the proportions for the same categories of the activities in Ogbomoso are 31.3 and 4.5 respectively. This accounts for the significant inter-city variation observed in the chi-square result of 16.24 and its p-value of 0.003 (less than 0.01). This implies that the type of ILU found in urban centre depends on the urban nature, and perhaps its function. All these need be put into consideration while trying to put a structure in place towards integrating the sector into the formal land use planning. Meanwhile, the question now is: how is the generated Incidence of Informal land use (IILU)

distributed among the various conventional land uses?

**Table 1. below shows the distribution of IILU among other urban land uses (excluding transportation):**

Land Use	IILU	%	Rank	Remark	F-value	P-value
Residential	30.06	22.01	2 <sup>nd</sup>	High		
Commercial	31.51	37.84	1 <sup>st</sup>	High		
Industrial	29.25	21.49	3 <sup>rd</sup>	High		
Public/Semi-public	10.32	7.58	4 <sup>th</sup>	Low	18.4	0.000
Recreation	6.25	4.59	5 <sup>th</sup>	Low		
Agriculture	6.00	4.41	6 <sup>th</sup>	Low		
Others	2.75	2.02	7 <sup>th</sup>	Low		
Total	136.14	100				

**Source:** Authors' survey, 2015.

It is revealed from Table 1 that with the IILU proportions of 37.84, 22.01 and 21.49 percent, commercial, residential and industrial land uses respectively and in that order, are highest generators/attractors of ILU, while public/semi-public, recreation, and urban agriculture with 7.58, 4.59, and 4.41 percent respectively are low generators/attractors of ILU. With f-value of 18.4 and p-value of approximately 0.00, such differences are statistically significant. That is, incidence of informal sector land use in an urban space depends on the predominant land use. This is an improvement on the earlier knowledge and findings, which emphasize the close relationship between incidence of informal sector activities and residential land use only (Jelili and Adedibu, 2006; Okeke, 2000; and Onyebueke, 2000). It is established here that while acknowledging the relationship between the ILU and residential land use (as a second highest generator/ attractor), the relationships between IILU and commercial and industrial land uses are significantly high.

It is important to mention that identification of such broad categories of urban land use only provides the relative importance of each broad land use category in the springing up of ILU. The analysis does not give us what amount of a given land use or land use mix with certain socio-cultural background will generate as IILU. This can only be done by analyzing land use categories not in isolation of other determining factors of IILU. Such factors as density, formality/organization, non-conforming land use and socio-cultural variables (itemized under methodology) when blended with other land use variables (here, factor-analyzed) provides a structure which is more meaningful and helps (when subjected to a predictive model) in explaining the process of integrating the ILU. This is the concern of the next section. Before then, however, it is necessary to examine the basic socioeconomic-cum-cultural characteristics of the informal operators briefly.

It is observed that the mean age, monthly income, length of stay, and level of participation in the sector are 33.74, N28040.40, 21.29 and 33.67 respectively for Ilorin, while the figures are 32.65, N19038.64, 21.47 and 55.27 for the same variables in Ogbomoso. Also, the percentages of female, native people, self-employed, and of those with less than secondary education are 39.1, 48.7, 69.8 and 22.95 respectively for operators in Ilorin, while observations on the same set of variables for those in Ogbomoso are 43.4, 64.6, 79.33 and 32.56 respectively. Comparing and testing the observations for the two cities, the results show that with p-values of 0.033 and 0.001, it is only observations on monthly income and nativity that vary significantly with city (in favour of Ilorin with a more average monthly income and more heterogeneous population).

#### ***The Emerged Structure in the Land Use and Socio-Cultural Variables Analysis***

The sixteen independent land use and socio-cultural variables were collapsed into six components, which were named after and defined according to the variables that loaded highly (either positively or negatively) on each. All the variables were distributed to the appropriate components by considering the highest absolute loading for each. This gives a structure that produces an identity for each component.

Table 2 shows that component 1, with 23.68 percent of the variance, has age, length of residency, little or no formal education, nativity and self-employment loading highly with it, and as a result described as 'less heterogeneous, indigenous neighbourhood', because such variables are characteristics of aged, indigenous urban neighbourhoods. Component 2 on the other hand, has such variables as major occupation in the informal sector and level of participation in the sector loading highly with it, and as a result described as 'level of participation'. The component accounts for 17.6 percent of the total variance.

**Table 2. Grouping of Variables and Labels for the Emerged Components**

Component	Label (Description)	% of Variance	Variables defining each
1	Indigenous less heterogeneous neighbourhood	23.68	Age, length of residency, little or no education, nativity, self-employment

2	Level of Participation in the sector	17.16	Major occupation in the sector, level of participation in the sector
3	High density commercial land use	14.60	Land use intensity, commercial land use
4	Residential Land use complexity	11.63	Land use mix, residential land use
5	Female Dominated self-employment	10.06	Income, % of female, self-employment
6	Residual factor	9.16	Income

Source: Author's Computation (2015)

Component 3 is described as 'high-density commercial land use' to reflect such variables as land use intensity and commercial land use, which load highly with it. It accounts for 14.6 percent of the variance. The 4th component, which accounts for 11.63 percent of the variance, has such variables as land use mix and residential land use loading highly with it, and as a result labelled 'residential land use complex'.

Accounting for about 10.06 percent of the variance is component 5. It has the variables of income, percentage of female and self-employment loading highly with it, and as a result christened 'female-dominated self-employment'. The sixth component, on the other hand, is regarded as a residual component, not only because of its unclear nature, but also and more importantly because it accounts for less than 10 percent of the variance.

The set of scores of the five components which are composites of their respective variables were fed into a regression model as independent variables (factors) with IILU as dependent variable. The result shows that, with a p-value of 0.000, the relationship between IILU and the five factors jointly (R) is 0.878, while the coefficient of determination (R square) is 0.771. This implies that 77.1 percent of a change in IILU is explained by the five factors jointly. However the nature and magnitude of the relationship between each of the factors and IILU separately vary. It is observed that, with a p-value of approximately 0.000 (i.e less than 0.01) and t-value of 0.8114 only factor 3 has a significant and highest relationship with the IILU, which is a confirmation of the earlier result that commercial land use is the highest generator/attractor of ILU.

Nonetheless, the contributions of all the factors to the IILU are explained in the calibrated model, using the regression coefficients.

From the results, a = nil (for standardized coefficients), b1 = - 0.025, b2 = -0.125, b3 = 0.847, b4 = 0.049 and b5 = -0.189, while y = IILU Therefore, the regression model is given as:

$$y = b_1x_1 + b_2x_2 + b_3x_3 + b_4x_4 + b_5x_5$$

That is:  $y = - 0.025x_1 - 0.125x_2 + 0.847x_3 + 0.049x_4 - 0.189x_5$

#### Model Simulation and Discussion

From the model (equation) above, it is inferred that a unit change in:

- (i) component 1 would result in about 0.025 change in

IILU

- (ii) component 2 would result in about 0.125 change in

IILU

- (iii) component 3 would result in about 0.847 change in

IILU

- (iv) component 4 would result in about 0.049 change in

IILU

- (v) component 5 would result in about 0.189 change in

IILU

The sign (negative or positive) indicates whether the relationship is direct or inverse. In other words, when it is positive, it implies that as the factor increases so does the IILU, and vice-versa.

Supposing we take each of the components as a land area of one hectare for: (1) indigenous, less heterogeneous sub-population, (2) people (a socio-economic class) whose major occupation are in the informal sector, (3) high-density commercial area, (4) urban residents other than those captured in the other components/categories here, and (5) participants in female-dominated self- businesses, respectively (as suggested by the model), the five (5) hectares of land will have in it an amount of informal land use (IILU) given as:

$$\begin{aligned} \text{IILU} &= - 0.025(1) - 0.125(1) + 0.847(1) + 0.049(1) - 0.189(1) \\ &= - 0.025 - 0.125 + 0.847 + 0.049 - 0.189 \\ &= 0.557 \text{ hectare} \end{aligned}$$

This is a hypothetical case; a given urban neighbourhood will have a given size with appropriate land areas for different uses. The sizes of land areas specified for different land uses of the neighbourhood shall be used in the formula to get the appropriate amount of land to be developed as informal land use within and among land uses.

Note, however, that in the emerged structure not all land use categories fed into the model become conspicuous. Majority of them are subsumed in the other conspicuous components or land use categories, not because they are less important, but because of the scale and nature of such land uses and more importantly because of the degree of planlessness in Nigerian and maybe in other similar African countries' cities. Nevertheless, all the land uses are taken care of in explaining or predicting the IILU to be anticipated given a unit form of physical development. How does it happen?

If we refer back to our hypothetical case of 5 hectares of land area, the 0.557 hectare of land to be produced as the ILLU is distributed among all the existing traditional land use categories based on the expected proportion to be contributed by each as revealed earlier in Table 1.

Note also that the model has directly or indirectly taken care of all classes of people. For example, while component 1 captures indigenous people who may wish to stay together as a community, irrespective of whether or not they participate in the informal sector activities, component 2 is all about major participants in the sector, whether or not they are native of the town. Component 3, on the other hand, does not talk on class of people. Component 4 is about residential areas for different socio-economic groups outside those mentioned in other components, while component 5 captures participants in female-dominated businesses.

This implies that for any urban neighbourhood of any known size and configuration, in terms of overall spatial extent, land area for each conspicuous land use and class of people to be occupying the neighbourhood, the model is adoptable and adaptable, and hereby recommended for use in integrating the informal land use into formal land use planning, and for test for cities of similar configurations in Africa.

#### Conclusion and Recommendation

From urban planner's perspective, this study has established and concluded that incidence and pattern of informal land use are predictable for urban neighbourhoods in African countries with similar urbanization drivers with the sampled Nigerian cities of Ilorin and Ogbomosho. While incidence of informal land use to be generated or attracted by each of the other formal and/or traditional land use categories may be predetermined, the land use complex for a given urban neighbourhood with certain anticipated socio-economic-cum-cultural characteristics may be established. A model for achieving this, which may be adopted or adapted, is hereby recommended for consideration.

It is also concluded that, given the observed diverse factors accounting for the growth of informality in African towns and cities, such as inadequate formal jobs, poor planning, and poverty, among others, policy measures should be directed towards the affected operators of informal activities in way to capture them in economic development planning process. Appropriate documentation of such activities should be done, but with a pro-poor tax or registration policy, which may encourage their 'parading themselves' as drivers of the informal economy.

It is also recommended that more research efforts be directed at unfolding other areas such as the linkages between the formal and informal land use, and on similar areas of study to cover other Nigerian and African cities for more robust comparison, inferences and paths to sustainable integration of the informal with the formal components of urbanization process

in Africa.

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# A Decision Support Approach to Land Rezoning/Redevelopment in Sustainable Urban Renewal

*Hao Wang*

(School of Management Science and Engineering, Central University of Finance and Economics)

**Abstract:** Urban renewal has become an unavoidable phenomenon in many developed countries and regions. How to redevelop a piece of land with an appropriate use which is compatible with current land uses in the surrounding area is a big challenge encountered by urban planners or decision-makers. This paper provides a prototype of GIS-based approach which can quantitatively assess land-use suitability for land rezoning/redevelopment in urban renewal areas. Specifically, this approach consists of a model for land-use suitability analysis and a land information database affiliated by providing required data and information for the suitability analysis. In addition, five types of land use are considered in this model: residential, commercial, industrial, G/IC (government/institution and community) and open space. Research methods such as expert interview, focus group meeting and case study are applied to this approach development, and several advanced techniques or tools such as GIS data processing and spatial analysis, multi-criterion analysis, AHP method are used for building this model and database. As demonstrated in the case study, people can be assisted in making decisions for land redevelopment and the planning process can be supported by using this approach to assess urban land-use suitability for site reuse in sustainable urban renewal.

**Key words:** Land rezoning, land redevelopment, urban renewal, GIS-based, decision support approach

## Introduction

Urban renewal is an imminent issue faced by many developed cities all over the world (Shen et al., 2014). As cities are getting older, central developed areas on which a large number of buildings are dilapidated and deteriorating usually cannot accommodate the changing need of urban sustainable development. As a result, urban renewal projects increasingly take place in central cities, during which land rezoning and redevelopment is the main task and goal (Wang et al., 2013). However, land rezoning/redevelopment is not a routine job, and it is much complicated due to the complex decision-making conditions. Current land use in urban renewal areas is mostly mixed, and population density within these areas is always high (Zheng et al., 2014). Since stakeholders with various aspirations from different sectors are highly involved in the decision-making process, land rezoning/redevelopment often take longer time than expectation. Therefore, how to facilitate the decision-making process of land rezoning/redevelopment is a long-lasting problem encountered by planning practitioners, and a tool or solution to supporting the complex process of land-use decision-making is highly needed.

This paper introduces an approach to supporting the decision-making process of land rezoning and redevelopment in urban renewal using GIS techniques. First, an overview of land

rezoning/redevelopment in urban renewal is given based on a comprehensive literature review. Second, the development process of the GIS-based approach is described. Third, a case study in Hong Kong is conducted to show the applicability of the approach. Finally, strengths and limitations of the approach are discussed and conclusions of the paper are drawn in the end.

## 1. An Overview of Land Rezoning/Redevelopment in Urban Renewal

### 1.1 Land Redevelopment as A Tool for Sustainable Urban Renewal

Urban renewal aims to deal with urban decay and change deteriorated built environment to meet current demand or better usage. The term “renewal” can be replaced by “regeneration” or “revitalization” with the same meaning (Roberts & Sykes, 2000). Urban renewal areas refer to built-up areas/districts where infrastructure such as road, water and electricity supply, and other service facilities have been established within the city boundaries. These areas usually situate in the central city or the downtown of cities, on which, probably, many old buildings need to be redeveloped or revitalized due to deterioration and lack of maintenance.

Urban renewal is regarded as a process involving “physical change, or change in the intensity of use of land and buildings” stemming from the “social, economic and environmental forces”

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**Author:** Dr. Hao Wang is an active researcher focusing on urban renewal, land use planning, and sustainable built environment. He has published about 50 academic papers in peer-reviewed journals and international conferences, and he also serves as reviewer for some highly-ranked journals such as *Land Use Policy*, *Cities*, *Habitat International*, etc.

imposed on the urban areas (Couch, 1990). It is a useful tool to cope with changing urban environment, aiming at meeting various social and economic objectives through regenerating the existing built environment. During the process of renewal design, design guidance and development control including both physical criteria and visual criteria regulate the implementation of the design to ensure a more livable and ecological urban space. Today's urban renewal is people-oriented and the outcomes of renewal projects serve mainly for living condition improvement. Population characteristics, household structures, community and neighborhood changes, and social needs of certain vulnerable groups should be considered to measure the social impacts of urban renewal. Internal mechanism and dynamics of urban space re-allocation can be examined based on economic concerns, such as the economic life of a building and the timing of redevelopment, and the economics of urban regeneration. Therefore, urban renewal can be successfully achieved only if the three elements of sustainable development, namely, social, economic, and environmental concerns are fully considered.

Land redevelopment is one way of resource re-use intrinsically reflecting the concept of sustainable development (Wang et al., 2014). In pace with urban development and increasing demands for a better living environment, the target of urban renewal has moved from the oversimplified clearance of large-scale slums to the improvement and rehabilitation of older areas (Couch, 1990). For instance, land redevelopment for housing improvement became the core of urban renewal policy several decades ago for the sake of improving the sustainability of urban services development.

### ***1.2 Factors Affecting Decision-making of Land Rezoning/Redevelopment***

In terms of sustainability indicators for urban development, Ambiente Italia (2003) identified ten indicator groups of common local sustainability by integrating local actions into sustainability measurements, such as Citizen satisfaction with the local community, Local mobility and passenger transportation, Availability of local public open areas and services, Quality of local air, Noise pollution, and Sustainable land use. Practically, the interpretation of sustainability at the local level (street/site scale) is quite different from the large-scale sustainability analysis. For local communities, the emphasis and difficulty is to measure and relate social attributes (e.g. local population density), environmental concerns (e.g. local air quality), and abstract perceptions like esthetics to the concept of sustainability.

Land rezoning, in essence, is a type of land use planning at the site level, which is called site planning. Site planning focuses on the smallest scale of controlled urban development. Since a renewal project normally covers one or two sites/lots, land redevelopment for urban renewal is mainly a process of site planning in central cities. During the planning, neighborhood

development is highly related to planning implementation. According to the Leadership Energy Efficiency Design (LEED) rating system for neighborhood development (USGBC, 2009), indicators for assessing the sustainability of neighborhood development are identified from five specific aspects: Smart location and linkage, Neighborhood pattern and design, Green infrastructure and buildings, Innovation and design process, and Regional priority credit.

Decision-making of land rezoning/redevelopment includes a process of land-use suitability assessment (LUSA), which is an appropriate means of quantifying constraints and opportunities of land redevelopment, and is able to support the decision-making process. Land-use suitability assessment is essentially a process involving multi-criteria decision analysis (MCDA). In other words, LUSA is an evaluation/decision problem with multiple factors, and these factors indeed affect the decision results. LUSA studies initially focused on agricultural land or meadowland in rural areas. For example, Bojorquez-tapia et al. (2001) presented a GIS-based multivariate approach for land suitability assessment with a public participation base and identified nine environmental criteria for suitability assessment, including Brackish water, Distance to major roads, Distance to agriculture and cattle ranching land, Coastal lagoons, Mangrove, Deciduous forest and scrubland, Soil type, Flood prone zones and Riparian zones. Burnside et al. (2002) developed a GIS-based habitat suitability model to support strategic landscape evaluation and to provide a method of identifying target (most suitable) sites for grassland restoration, in which three topographic variables – Elevation, Slope and Aspect were assessed. Jafari and Zaredar (2010) adopted a spatial AHP method to determine the most suitable areas for rangelands, which involved 14 criteria, namely Erosion, Soil hydrology, Soil depth, Soil structure, Soil texture, Vegetation type, Vegetation density, Rainfall, Temperature, Slope, Elevation, Land use, Distance from population centers and Distance from surface water.

In addition, LUSA studies particularly on urban land have been conducted over the last few years and some common factors affecting land-use decisions were identified. For instance, Dai et al. (2001) illustrated a GIS-aided geo-environmental evaluation for urban land use planning from the viewpoint of geological features of land. 13 factors for suitability evaluation - Slope, Elevation, Surficial geology, Formation combination, Lithology of bearing layer, Depth to groundwater table, Corrosive potential of groundwater, Groundwater rise, Distance to debris flow, Distance to landsliding, Liquefaction potential and Distance to fault were selected for high-rise buildings, multi-storey buildings, low-rise buildings, waste disposal and natural conservation urban land use categories. Gomes and Lins (2002) applied a method integrating GIS and MCDA to aiding spatial decisions for municipal district evaluation in respect to

quality of urban life. They defined 14 exclusion criteria for measuring the quality of urban life from the aspects of infrastructure, education, security, health and work. Aly et al. (2005) considered suitability assessment for urban development from the perspective of engineering geology, by developing a GIS-based model that incorporates suitability factors such as land use/cover, types of soil, Karst feature distribution, fracture densities, slopes, distances to major faults, streams and road network, and city boundaries.

Specifically, different sets of affecting factors were categorized in accordance to various land uses. Joerin et al. (2001) described a decision support method for land use suitability assessment for housing by combining MCDA with GIS, identifying eight significant criteria. Yang et al. (2008) incorporated remote sensing, landscape ecological analysis and GIS into their land suitability modeling to develop a spatial analysis system for evaluating the suitability of urban expansion land. Eight factors were used, comprising Surface water parameter, Normalized difference vegetation index (NDVI), Soil penetrability, Soil fertility, Slope, Foundation capacity, Resident land use information and Landscape value. Dai et al. (2008) evaluated the suitability of industrial land use in land use planning of industrial cities on the basis of ecological suitability evaluation, identifying seven factors: Current land use, Slope, Distance to river, Density of green surface, Distribution of pollutant sources, Distance to road network and Distance to residential areas. Wu et al. (2009) investigated urban land use patterns by modeling the spatial autocorrelation of land use types, with the purpose of deriving better spatial land use pattern on the basis of terrain characteristics and infrastructural conditions. In their study, the land uses were divided into four types - cultivated land, forest land, construction land and virgin land - and 12 driving factors, including distance to town, distance to river, distance to road, population density, digital elevation model (DEM), slope and aspect to represent the geophysical and socio-economic conditions involved. In particular, Wang et al. (2014) developed a framework of factors which affect decision-making process of land use planning for urban renewal projects, and seven factor categories including environmental, social, economic, political, locational, cultural, and physical factors were identified.

## **2. A Prototype of Decision Support Approach**

### ***2.1 Decision Support Model***

The development of the model includes criterion identification, weighting assignment, and rating standard determination.

#### ***2.1.1 Criterion Identification***

Identifying the criteria for LUSA in sustainable urban renewal is the first step in model development. Basically, one criterion can be regarded as one affecting factor considered in

the decision-making process. Factors/criteria play an important role in the measurement and quantitative analysis in the planning practice, and the relationship between planning theory, measurement and policy-making is described as a tangled triangle, which means that the measurement should be guided by theories and the factors are developed to achieve the quantitative or qualitative measurement for facilitating policy-making. Therefore, the criteria should be identified based not only on relevant literature from planning theories, but also on expert opinions from planning practice.

Based on the planning factors normally considered in site analysis and land rezoning/redevelopment, a general list of criteria for land-use decision-making in urban renewal can be identified to assess land-use suitability and measure the sustainability of land-use reallocation.

#### ***2.1.2 Weighting Assignment***

Weightings of each criterion are determined by using the AHP method, and importance scores (the weightings) are automatically calculated in a software toolkit developed on the principle of AHP theory. AHP is a powerful and commonly used tool for decision-making in land-use suitability issues, involving social, environmental and economic factors (Jafari and Zaredar, 2010). In combination with GIS technology, the Spatial AHP (SAHP) method was introduced for spatial multi-criterion analysis and has become a new feature in LUSA. AHP has several advantages over conventional LUSA techniques. Firstly, it relies less on the completeness of data, and more on expert opinions/ preferences concerning the factors of land suitability. Secondly, it allows both planners and the other stakeholders to express their views in making land-use suitability measurements. Without the AHP method, the land suitability mapping technique cannot incorporate the preferences and considerations of different stakeholders. Thirdly, it is more transparent and more likely to be accepted, especially when the results of LUSA serve as a reference for land use decisions in practice.

To achieve this process, a focus group meeting (like a charrette) is conducted to collect the opinions of decision-makers. The focus group consists of six to ten stakeholders of land rezoning (e.g. urban planners, land developers, and surrounding residents). During the meeting, the comparison matrices used in the AHP process are filled up according to the views of the focus group rather than individual participants of the group. This process reflects and improves collaborative/participatory planning by involving different stakeholders in decision-making.

#### ***2.1.3 Rating Standard Determination***

Even though criteria and their weightings are ready, a complete assessment cannot be achieved without rating standards. In this model, the rating standards are formulated on the basis of planning standards, land development regulations and expert opinions, and are verified by the focus group of

stakeholders in the decision-making of land rezoning. The approach of multi-criterion evaluation/decision analysis (MCE/MCDA) is applied in the whole process of LUSA.

### **2.2 Land Information Database**

During the development of decision support model, base data/information associated with the criterion categories in the model are collected and prepared prior to the comprehensive analysis. Here the database is digitally built in GIS software "ArcGIS" with the form of "Geodatabase".

#### *2.2.1 How Is Information Involved*

As the information collected during planning processes is the basis of decision-making and actions, full processing of information which complements and supports decision-making of land rezoning includes three phases: collection, storage and retrieval, and analysis. The first step is to collect all kinds of information required. One important issue in this stage is to make sure that all collected information can be translated into a comprehensible, transmissible and transferable form. This is because one most adapted form/format of collected information needs to be chosen when the information is linked and coordinated with the others as well as the other phases of data processing. The second step is to establish an environment to store and retrieve information. To efficiently make use of information, it must be kept with a ready accessibility. A database is usually used to keep such information with the aid of computer technology. Even though too much information is involved in planning tasks, in particular, every piece of information can still be identified and retrieved in a quick response. The third step is to analyze and interpret information for providing references for decision-making. Information is gathered ultimately for assisting and advancing people's understanding on certain problems/issues.

Three steps of data processing in the development of the database are as follows: specifying data required, associating the data with specific methods of data processing, and evaluating the practicability and applicability of the database. The three sequential steps seem to be simple and uncomplicated, however, the steps are intercrossed by each other and each step may be adjusted at any time due to the complex and dynamic urban system.

#### *2.2.2 What Is Information Involved*

Specifying required information for land rezoning is the first stage of the database development. At this stage, crucial information generally considered in urban/land use planning is identified and defined first. For example, statistics of local population refer to current and projected demographic information such as population, employment, number of households. Financial conditions of people and government include income characteristics of the population, property values, GDP, etc. Physical conditions of the land/location stand for the topographic and spatial information of the land such as slope,

terrain, and soil. Urban internal structure and functional relationships are the most complex information required in the planning, which are a series of considerations and criteria in terms of internal accessibility and functional distribution for identifying particular uses for each piece of land according to its size, value and location.

Land rezoning can be a type of site planning on existing developed land, which aims to organize the redevelopment of each single piece of land by determining specific land uses (i.e. locating buildings and facilities) on the site, arranging for roads, water, and other inside infrastructure, and developing detailed plans for grading, landscaping, and other site improvements. During the process of site planning/design, in many cases, site analysis is the first and the most important step as it aims to collect information related to the site, assess the land-use suitability of the site and the compatibility with the proposed land use and surrounding environment, and understand the administrative requirements of the on-site project(s) such as building permits and other approvals. Russ (2002) gave a checklist of information involved in site analysis including site condition, land development regulations, utilities (access distance), topography, vegetation/wildlife, historic/cultural/community features, and environmental concerns.

The relationship between GIS mapping and land use (site) suitability analysis is that, the inventory maps of land rezoning containing site information will be synthesized to generate land-use suitability maps for site analysis. Based on the existing literature and site planning standards, a tentative list of information/data included in the database associated with the decision support model can be provided.

The data involved in the decision-making process are complex and in a huge amount. To improve the efficiency of data processing and management, database is a good way to storing, converting and managing the large volumes of data. GIS mapping becomes an indispensable and popular tool for base data gathering and analysis throughout the dynamic planning process. With the capability in geographic statistics and visualization, it can be used to provide a comprehensive picture of an existing community in terms of terrain, landscape, transportation, energy consumption, housing types, demographics, air quality, and other measures.

## **3. Pilot Study: Preliminary Application of The Approach**

### **3.1 Study Area**

Yau Tsim Mong is one of the older districts of Hong Kong, having been developed over one hundred years (Wang et al., 2013). It is located in the Kowloon peninsula - one of Hong Kong's metropolitan areas - spanning over 114° 09' – 114° 11' E and 22° 17' – 22° 19' N. The area covers 7 km<sup>2</sup> and with a current population of 304, 900. The land in this district is highly

developed and infrastructure such as roads, railways, and main service facilities are already provided. Therefore, the study area serves as a good case for the application because of its location and development level.

Currently, many older buildings located in the area are too old to maintain their original function and need to be redeveloped for future use. Urban renewal is a major contemporary issue in Hong Kong. Until 2016, 69 redevelopment projects have been launched by the Urban Renewal Authority (URA) of Hong Kong and the issue of land use decisions for redevelopment projects has become an increasing problem for town planners from the perspective of sustainable urban renewal. Thus, this area is most appropriate for an empirical study of land rezoning in urban renewal and can reflect the characteristics and merits of the proposed approach.

### 3.2 Decision Support Model

According to general procedures for developing the approach described in the above section, decision support model consisting of three parts i.e. criteria of LUSA for land rezoning, weightings of the criteria, and rating standards of the criteria was practically developed for the case study.

#### 3.2.1 LUSA Criteria Identified in Hong Kong

Based on literature review and findings of the interviews conducted in Hong Kong, LUSA criteria for land rezoning/redevelopment in Hong Kong were identified as shown in Table 1.

**Table 1. LUSA criteria in the pilot study**

Criterion type	No.	Criterion name
I. Physical/Inherent attributes	1	Current land use
	2	Slope
	3	Elevation (relative)
	4	Vegetation
	5	Distance to CBD/BCCs
	6	Distance to airport
	7	Distance to railway/MTR stations
	8	Distance to bus terminus
	9	Distance to ocean/streams
II. Locational attributes (Accessibility/compatibility)	10	Distance to historic sites (Preservation)
	11	Distance to nearest hospital
	12	Distance to nearest primary/high school
	13	Distance to open space
	14	Distance to trunk roads

III. Social attributes	15	Population density
	16	Employment density
	17	Unit price of land sale
IV. Economic attributes	18	Property average price/rent
	19	Air quality
V. Environmental attributes	20	Traffic noise

These 20 criteria of LUSA for land rezoning were classified into five categories, namely physical/inherent, locational (accessibility/compatibility), social, economic and environmental attributes. Physical/inherent attributes refer to the physical or existing conditions of land lots, such as slope, elevation and current land use. These restrict land use in the perspective of inherent conditions of the land sites. Locational attributes represent spatial accessibility and compatibility, and they are currently regarded as the most important factors affecting land use decisions in urban renewal projects. Ten of the twenty suitability criteria were locational criteria, such as distance to MTR, distance to open space, and distance to historic sites. The distance was measured based on factual road network and automatically calculated by using GIS network analysis. And the road distance can also be converted to time distance through estimating average speed. For example, the average speed of walking is about 5 km/h (84 m/min), and for driving in urban areas is around 50 km/h (840 m/min). In addition, social, economic, and environmental attributes were identified to reflect the sustainability of land use. Six criteria were chosen for the three attributes, with each category having two criteria. The six criteria including population density, property average price, and traffic noise covered the main issues of land use sustainability, and suggested a more effective and convenient way to quantifying land use sustainability.

#### 3.2.2 Weightings of The LUSA Criteria

A focus group meeting was conducted to determine weightings of the criteria identified in the pilot study and verify the rating standards of each criterion. The focus group was comprised of 8 participants (rezoning stakeholders in the specific case) who were 4 town planners working in the Planning Department and URA, 2 developers working in local companies and 2 residents living in the study area. The involvement of the participants from the Planning Department, URA, and the public contributes to participatory planning with different stakeholders and public engagement in the planning practice. The meeting consisting of four sessions lasted about two hours. Two tasks were included: the first was weighting determination with an AHP process and the second was the verification of rating standards.

The first objective of the focus group meeting was to determine the weightings of LUSA criteria based on the views of decision-makers/stakeholders. Focus group is a good means to achieve a consensus/agreement among different stakeholders

when making decisions in land rezoning. In fact, different criteria may be applicable to different land uses; in other words, land use decisions are made according to different sets of criteria when specific land uses are varied. For example, the criterion of traffic noise is sensitive to residential use but commercial use. In this study, five types of land use which were residential, commercial, industrial, G/IC, and open space were defined and considered for LUSA. Therefore, the specific sets of criteria which actually affect decision-making for the five different land uses were identified before determining the weightings of each criterion. Based on the 20 criteria shown in Table 1, the participants of the focus group were asked to discuss and select the specific criteria for five particular land uses in the beginning, and five sets of criteria were selected from the 20 available criteria according to the group opinions (refer to Table 2).

When using AHP method to compare the relative importance of every two criteria, some criteria cannot be directly compared since they were not in the same attribute. For instance, ‘Slope’ in physical attribute cannot be simply compared with ‘Distance to MTR’ in locational attribute to distinguish which is more important for land use decisions. Therefore, the criteria must be put into different categories, and at least two levels (hierarchy structure) were formed according to the criteria and their attributes so that their importance was only compared within each level. Figure 1 shows the hierarchy structure of LUSA criteria for commercial land use as an example.

Level 1 – Criterion attribute	Level 2 – Criterion (No.)
Physical/inherent	1-3
Locational	5, 7, 8, 10, 14
Social	15,
Economic	17,
Environmental	19

Figure 1. Hierarchy of LUSA criteria for commercial land use

The matrices of importance comparison were formed in accordance with two levels: criterion attributes and the criteria. Taking commercial land use as an example, the first matrix was tabulated at Level 1 (Table 2) and then other matrices were

formed within each criterion attribute at Level 2. Table 3 illustrates the matrix for locational criteria, indicating that the importance weighting of locational attribute included the weightings of eight specific criteria. By filling up these matrices based on the views of the focus group, the weightings of each criterion were calculated and the total of all criteria applied in each land use was 1.0.

Table 2. Matrix for criterion attributes

Criteria	A1	A2	A3	A4	A5
Attributes	(Physical/inherent)	(Locational)	(Social)	(Economic)	(Environmental)
A1	1				
A2		1			
A3			1		
A4				1	
A5					1

Note: the blank cells are filled following 1-9 scale AHP method

Table 3. Matrix for locational criteria

Criteria (Locational) Ci	C5	C7	C8	C10	C14
C5	1				
C7		1			
C8			1		
C10				1	
C14					1

Note: the blank cells are filled following 1-9 scale AHP method

By using AHP software - ‘Expert Choice’, the weightings of five sets of criteria were calculated based on the comparison matrices presented above, and the five sets of weightings for different land uses were obtained.

### 3.2.3 Rating Standards of The LUSA Criteria

The second objective of the focus group meeting was to adjust and verify the rating standards for LUSA. A tentative set of rating standards was formed based on Hong Kong planning standards and guidelines, general regulations of land development and design requirements of urban renewal before the meeting. During the second half of the meeting, eight participants were asked to discuss the applicability of the tentative rating standards and make some adjustments if necessary. This session of group discussion lasted for about 40 minutes to allow the focus group to verify the rating standards. After combining the views of the focus group, the rating standards were finalized. An example of rating standards for criterion “current land use” is shown in Table 4.

**Table 4. Suitability classification and rating standards of criteria “current land use”**

Criterion	Land uses	Rating standards			
		Highly suitable	Suitable	Unsuitable	Very unsuitable
		3	2	1	0
Current land use	Residential	R	C, G/IC, V/O	I	O
	Commercial	C	R, G/IC, I, V/O	O	-
	Industrial	I	G/IC, V/O	R, C	O
	G/IC	G/IC	C, I, R, V/O	O	-
	Open space	O, V/O	I, R, G/IC	C	-

**Note:** R – Residential, C – Commercial, I – Industrial, O – Open space, V/O – Vacant/Under Construction/Others;

To achieve land-use suitability assessment in the study, criterion standardization, weighting and composite scoring were done with the help of MCE. This model provided a quantitative approach to the assessment, including the classification of land use suitability, rating of criterion values, and scoring for multi-criterion analysis. Firstly, land use suitability was classified into four levels - very unsuitable, unsuitable, suitable and highly suitable classes - and integers ranging from 0 to 3 were assigned accordingly (refer to Table 8). Secondly, the value of each criterion was obtained from the land information database, and each criterion was correspondingly assigned a certain suitability level according to the rating standards. These ratings standards are a crucial part of the model and were determined by referring to the literature, Hong Kong planning standards and guidelines, and the views of the decision-makers for land rezoning in urban renewal projects. Thirdly, a linear scoring formula was used, in the form of

$$S_i = \sum_{j=1}^n [R_i(j) \times W(j)]$$

where  $S_i$  denotes the land use suitability of land site  $i$ ,  $i$  is the number of land sites;  $j=1, 2, \dots, n$  is the number of criteria;  $R_i(j)$  refers to the rating of criterion  $j$  of the land site  $i$ ; and  $W(j)$  is the weighting of criterion  $j$ . By overlaying map layers (which can be found in Section 6.4) of the selected criteria with their respective weightings, the final scores of each land site are calculated. The suitability grade of each land site is also divided into four levels according to the final scores: very unsuitable (0-0.75), unsuitable (0.75-1.5), suitable (1.5-2.25) and highly suitable (2.25-3).

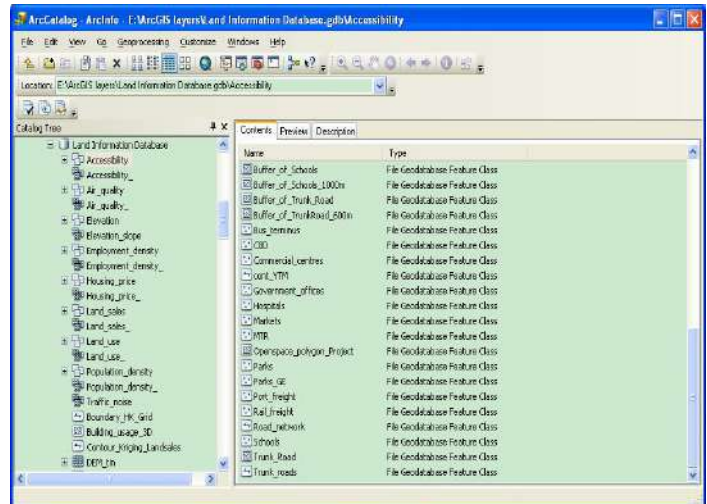
**3.3 Land Information Database**

**3.3.1 Database Environment Setting**

The process of the database development is described as follows. Firstly, raw data were collected in accordance with the criteria considered in the model. Secondly, the collected data were processed through digitization, format conversion, and spatial analysis to prepare usable input data for the model. Finally, the directly usable data were stored in the database with the form of map layers.

The database was built in the environment of “ArcGIS” – a powerful GIS toolkit. The collected data were processed in one module of the software – ArcMap (ArcInfo), and the database was created with the form of File Geodatabase in another module of the software – ArcCatalog and all data were stored in the File Geodatabase. The interface of the database created as a File

Geodatabase in “ArcGIS” is displayed in Figure 2.



**Figure 2 A screenshot of the database in “ArcGIS”**

**3.3.2 Data Collection**

Before data collection, the required data/information was identified in accordance to the criteria for LUSA given in the decision support model. To provide the information needed for LUSA in the model, volumes of raw spatial data such as digital topographic maps, aerial photos, and land utilization map as well as many non-spatial data such as statistical tables recording the information of population, employment, and housing price were collected for this database. Some of the raw data could be obtained from the governmental websites, for example, Outline Zoning Plan (OZP), traffic noise distribution, population distribution, API, and some needed to be purchased from government offices or relevant institutions, such as topographic maps, aerial photos, and transaction records of housing prices. The assembly of raw data is the foundation of decision support, and it can provide sufficient information for decision-making in land rezoning with geospatial visualization.

The quality of data collection restricts the completeness of criteria considered for LUSA in the pilot study, and the validity of the collected data (e.g. accuracy, data update) influences the results of LUSA. Data collection is a very important step of the database development, and the quality of raw data and the data sources must be verified during the collection process.

**3.3.3 Data Processing**

The raw data cannot be directly used in the model, and they must be processed to fit the model. The data processing included two steps: (1) GIS digitization and format conversion, and (2) spatial analysis for criterion-value generation.

In the first step, some raw data which were not GIS digital format were digitized in “ArcGIS”. During the process of digitization, several kinds of jobs may be involved: hardcopy scan, statistics input to the computer, and digitization in “ArcGIS”. For instance, a hardcopy of map needs to be scanned to be a digital map, and be further digitized into GIS format with appropriate geographic coordinates. Statistical data such as records of housing price need to be input to a table (e.g. Excel file) on the computer, and be linked to certain map layers in “ArcGIS”. In terms of format conversion, all digital data stored on the computer with whatever original format need to be converted into the file format of File Geodatabase in “ArcGIS”. After that, all raw data were digitized and/or converted into the storage format of File Geodatabase.

In the second step, the GIS digitized data were further processed through GIS spatial analysis in “ArcGIS” to provide criterion values for the model. During this step, many tools integrated in the ArcToolbox of ArcInfo for all kinds of spatial analyses such as Create TIN, Slope, and Kriging were used to generate the desired input data for the model. A Geoprocessing model was created using ModelBuilder in “ArcGIS” to automatically generate the values of the 20 examined criteria (i.e. the 20 map layers). The ModelBuilder is an application used to create, edit and manage Geoprocessing models for spatial data

analysis.

### 3.4 Results of LUSA by Using The Approach

Land-use suitability maps for five land uses were generated based on the LUSA criteria. For each type of land use, every land site located in the study area was classified into four suitability grades as described in Table 4. 86 land sites were assessed and classified into three different levels for residential use – highly suitable, suitable and unsuitable, two levels for commercial use and open space – highly suitable and suitable, two levels for industrial use - suitable and unsuitable, and only one level for G/IC use – suitable. The different suitability levels were categorized on the basis of the integrative consideration of the multiple attributes of each land site, such as physical conditions, locational (accessibility/compatibility), economic, and traffic noise assessment. These results of the LUSA indicated that, in the study area, almost all land sites were suitable for residential, commercial, G/IC use and open space, and part of the land sites were unsuitable for industrial use. By using this GIS-based approach, the specific land sites can be easily found and located on the maps.

Based on the final scores of land-use suitability calculated by the model, the most recommended land use was assigned to each site (i.e. land use with the highest score was considered as the most recommended type). Figure 3 shows the most recommended land-use pattern in the study area, which can be used as a reference for decision-makers in the process of land rezoning/redevelopment (Residential – orange diagonal, Commercial – yellow diagonal, G/IC – green circle, Open space – blue curve).

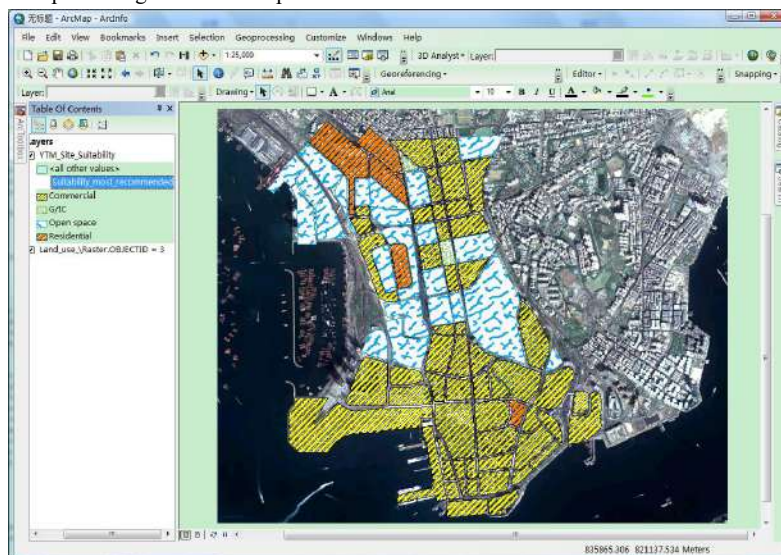


Figure 3. The most recommended land use for land rezoning

## 4. Discussions

In the pilot study, 86 land sites with five urban land uses were investigated based on the required information provided by the database. Although the results of suitability analysis may not be comprehensive, they could illustrate the potential outcomes of using this approach. In addition, the results also quantified the

land-use suitability based on the LUSA criteria, and they could serve as a reference for land-use decision-making through combining more considerations on other factors which were not included this time.

The main contributions of this paper are highlighted as follows. Firstly, this paper has identified general criteria for



land-use decision-making in land rezoning (including sustainability criteria) and the sources of the associated data/information. Secondly, this paper has developed a quantitative approach to assessing land-use suitability for land redevelopment (i.e. the decision support model) and a standard measure of providing usable data for the model (i.e. the land information database). Thirdly, this paper has demonstrated the usefulness of GIS visualization and spatial analysis in land rezoning, in particular, land redevelopment in urban renewal, and expanded GIS applications to the planning practice.

### 5. Conclusions

Land rezoning/redevelopment in urban renewal is a complex and necessary means for sustainable urban development. In order to facilitate the decision-making process of land rezoning, this paper develops a GIS-based approach consisting of decision support model and land information database to support land rezoning in sustainable urban renewal. The details of the development and application of the approach including the model and database were illustrated through a case study to show the viability of the approach. Although the land-use suitability was analyzed on the basis of incomplete criteria so far, the land-use suitability maps were still generated based on the criteria considered in the study to demonstrate the potential and validity of the approach. The successful case study reflects the good applicability of the approach, and implies that the same methodology can be applied to other places in the similar context of urban renewal. In the future, the results of LUSA based on complete criteria identified in the study could be generated to fully demonstrate the effectiveness of the approach. The further work includes special studies on certain criteria (i.e. input data for the model) and qualitative criterion quantification, such as feeling-based cultural concerns.

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# Local University Intellectual Capital Transformation of Fusion Depth of Research

Ran Li<sup>a</sup> & XiaoHong Zhang<sup>b</sup>

(a. Shinawatra University , Nan Yang Institute Of Technology; b. Shinawatra University)

**Abstract:** The intellectual capital transformation of fusion depth study is the important embodiment of social service function and important carrier. At present, the development of China's reform is in a crucial stage, all kinds of contradictions and problems in economic and social development is complex, needs to take effective measures to crack. At the same time, China is a large country, and the basis of regional development, conditions, resources, objectives, priorities and challenges of each are not identical, such as need more deeply integrated with pertinence and effectiveness of the production, the intellectual capital transformation of policy measures and solutions. Relying on local university to study, therefore, the intellectual capital transformation of depth fusion, social and economic development is one of the essential, feasible and urgent measures of innovation.

**Key words:** local university, study depth fusion, Intellectual capital transformation

## 1. local colleges depth integration of production, study and the importance of intellectual capital transformation

### 1.1 local university more conducive to the intellectual capital of fusion depth study into realistic productivity

The central "on deepening the reform of science and technology system to speed up the construction of national innovation system opinion" pointed out that research institutes and institutions of higher learning for more support and service for the enterprise technology innovation, promote innovation elements such as technology, talent flow to the enterprise research and development institutions; Support industry backbone enterprises and research institutes, institutions of higher learning set up technology research and development platform and industry technology innovation strategic alliance, cooperation to research and develop the core key technologies and related basic research, cultivate talents together, sharing scientific research; To encourage research institutes and institutions of higher learning of science and technology personnel to establish science and technology enterprises, promote the research and development achievements." "much starker choices-and graver consequences-in" national science and technology innovation plan "pointed out that to" around get through the channel of technology and economy, to the technology market, capital market and talent market, by means of open resources sharing, the surrounding industrial chain deployment innovation chain, perfect capital chain around innovation chain, strengthen the cooperation between all kinds of innovation main body, promote the combined closely with the

production, use, promote the development of science and education integration ".Through production, depth fusion, cluster innovation resources, and promote the innovation elements flow and optimized allocation, to speed up the intellectual capital into realistic productivity, stimulate the innovative entrepreneurial energy of the whole society.

### 1.2 local university more conducive to production, deep integration of intellectual capital into the industry competitiveness

With human society into the era of knowledge economy, competition between countries is increasing, all countries gradually realize the industry competitiveness is the core of national competitiveness, and enhance the competitiveness of industry, the key is to have key generic technology industry. At present, the upgrading of industry technology accelerated, key generic technology industry has become the bottleneck factor in the development of industry, therefore, focus on the social from all walks of life science and technology power support industry key generic technology research and development is to promote the competitiveness of the industry, thus in the fierce international competition environment based on the key. Local colleges and universities focus on intellectual capital of the industry key generic technology research and development activities in the industry, can improve the ability of effective supply of key generic technology industry, industry development to provide strong support to the industry.

### 1.3 local university more conducive to the intellectual capital of fusion depth study into social service ability

Production, deep integration of intellectual capital transformation is the important embodiment of social service

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Author: Ran Li, Shinawatra University , Nan Yang Institute Of Technology; XiaoHong Zhang, Shinawatra University.

function and important carrier. At present, the development of China's reform is in a crucial stage, build a well-off society in an all-round way of the task is very arduous, complicated economic and social development in various contradictions and problems, needs to take effective measures to crack. At the same time, China is a large country, and the basis of regional development, conditions, resources, objectives, priorities and challenges of each are not identical, such as need more deeply integrated with pertinence and effectiveness of the production, the intellectual capital transformation of policy measures and solutions. Since China's reform and opening up, especially since the implementation of the "double top" strategy, each province and at least one and so on, the higher levels of study, the discipline more sufficient talent comprehensive strong "double top" university, the goal is to major national demand as the guidance, around the economic and social development and national strategy, to build with Chinese characteristics and a new type of intellectual capital in university, the influence of the world focus on improve the high level scientific research ability and improve the service of the country's decision-making ability and solve a major bottleneck restricting the development of economic and social problems. Relying on local university to study, therefore, the intellectual capital transformation of depth fusion, is the economic development of one of the essential, feasible and urgent measures of innovation. Local colleges and universities is an important force in China's higher education, in education, science, technology and personnel system has the irreplaceable important position. In the long-term service in the economic development in the course of running a school, local university basic professional Settings around the industrial chain, gradually formed a closely related to industry, relatively centralized system of characteristic specialized subject. At present, how to take advantage of local colleges, through production, intellectual capital into depth fusion, to promote scientific and technological achievements, industrialization, capitalization innovation service for economic development has become we are faced with the urgent topic.

## 2. Relevant concepts defined

### 2.1 Production, depth of fusion

Production, usually refers to the depth of fusion between enterprises and universities and research institutes of technical cooperation, especially the demand for enterprise technology, in order to research for technology suppliers industry-university-institute cooperation relationship; Also the scholar thinks refers to colleges and universities and enterprises, taking advantage of the factors of their possession, collaboration to achieve a technological innovation behavior of the process. With the rise in recent years, compared to the cooperation between enterprise and enterprise innovation, and research and the fusion of enterprise appear to be more intense function

complementary advantages; It is also a kind of cooperation between the heterogeneous organization, namely the economical organization of cooperation with science and technology organization behavior, make the technological innovation activities better reflects the unity of its science and technology and economy. Therefore, depth integration of production, study and is an effective form of implementing technical innovation activities. Study abroad, there is no corresponding English vocabulary, "University of industry" and "Government University industry" with the more. "Production" here refers to the industry, "learning" refers to the academic circles, "officer" refers to the government.

### 2.2 Intellectual capital

To the earliest definition of intellectual capital is the American scholar Thomas. A. Stewart, he defines intellectual capital as, "all members in the company knows for enterprises to achieve competitive advantage in the market of the sum of things", proposes the intellectual capital H-S-C structure, namely the intellectual capital value embodies in enterprise human capital, structural capital and customer capital among the three. Brooking(1998) in the third resources: intellectual capital and its management, the meaning of the intellectual capital embodied in a simple formula, namely enterprise = tangible assets + intellectual capital, and points out that intellectual capital assets, including market talent assets, intellectual property assets and infrastructure assets. Hubert, st. Onge defines intellectual capital as: employees the sum of capital, organization capital and external relationship capital. Nick Bontis(1999) argues that intellectual capital has double multidimensional structure, intellectual capital = human capital + structure of capital + relationship capital. Human capital refers to attach to the recessive knowledge employees; Capital structure refers to the organization specification; Relationship capital is refers to the company and the external environment building attached to the relationship of knowledge, namely the relation network.

### 2.3 local colleges

Local colleges is belonging to the provinces, autonomous regions and municipalities directly under the central government, Hong Kong and Macao SAR, most rely on local fiscal support, by the local administrative department of the transfer funds are more than 2500 regular institutions of higher education, as the main part of the higher education system in our country, to serve the regional economic and social development as the goal, strive to cultivate high-quality talents for the local.

### 2.4 Intellectual capital transformation

Intellectual capital transformation in the universities and enterprises as the leading factor, integrate within the organization and organizational advantage resources, in order to realize the knowledge value-added for the purpose of complex process, transformation of intellectual capital levels will be measured in knowledge conversion efficiency. Intellectual

capital transformation to knowledge increment and value creation as the goal, the process is based on the research of falsified structures, needs to be innovated in practice embodied. Of intellectual capital transformation based on the above definition, the intellectual capital transformation mainly contains the research covers the following aspects: first, production integration. Knowledge through knowledge management process in organization knowledge absorption and release of coding and the output, the recessive knowledge into editable, explicit knowledge can pass, can add value. Through a lot of production practice, the efficient knowledge research results in the lab or research institutions to the values of the means of conveying to the application guide of the enterprise, realize the productivity of knowledge; Second, the commercialization of knowledge. In narrow terms, efficient and commercialization of research knowledge, makes knowledge quickly through the value realization of the channels and production application in various fields, realize knowledge capitalization, funding for colleges and universities or research institutions. From a general point of view, efficient and at the institute for the study of knowledge itself can be hatched independent Russian technology derived enterprise or independent economic entity, enterprise or business operations in colleges and universities the direct way to realize the commercialization of knowledge; Three, collaborative innovation efficiency of knowledge. In colleges and universities, enterprises and government in collaborative innovation system, in addition to the explicit knowledge achievement has realized the transformation of value-added, and achievements of tacit knowledge through the form of knowledge spillover in collaborative innovation between different subjects create recessive social and economic benefits.

### **2.5 Production, integration of intellectual capital**

Production, integration of intellectual capital can be defined as associated with the integration of production, study results from the sum of the knowledge of the colleges and universities and research institutions. How we study study and research of knowledge into enterprise intellectual capital, and the resulting product innovation, integration of efficiency and competitiveness in the future.

### **2.6 Production integration way**

Production integration refers to the way in which a certain system environment, the production, study and research the parties to achieve their goals of science and technology, capital, production equipment, the optimal allocation of social resources, including personnel training, as well as for the reasonable distribution of the output of interest. Integration of production, as the integration of science and technology, education and enterprise specific forms, formed in the course of the development process of multiple fusion methods: main achievements transformation model, project entrust mode, training mode, cooperative research and development mode,

platform operation mode, strategic alliance mode.

## **3. local university intellectual capital transformation of fusion depth of SWOT analysis**

### **3.1 Strengths**

Summary of 50 years of experience in running a school, most of the local colleges and universities in our country has been in the teaching, scientific research, social service and so on various aspects has formed a unique advantage, main show is: first, there is a group of closely related to the development of science and technology and industry, targeted and applied are strong platform for the high level of discipline, able to timely follow up and resolve important key strategy in the development of industry and technical problems; Second, there is a high level of professional talent team, professional distribution of relative concentration; Third, for the industry elite talent cultivation and leading educational philosophy and university culture, has outstanding practice in teaching, scientific research, emphasizes the application, pay attention to the traditional service; Fourth, the students' practical ability and professional quality are generally stronger; Fifth, adhering to the "service for the purpose of" mostly, and the corresponding industry development has very strong interactivity, is helpful to form a strong alliance of industry, Local colleges and most condition higher level characteristic development road.

### **3.2 Weaknesses**

At present, the development of local colleges and universities disadvantages of main show is: first, professional small, narrow marketability, emphasize professional counterparts; Second, in the aspects such as teaching, scientific research and social service generally only for demand in the industry, less consider should play their role in society; Third, the school management in the administrative color heavier, often "too" death; Fourth, the local colleges and universities development are greatly influenced by industry fluctuation; Fifth, the division management disciplines and redundant construction technology platform, resource utilization is low.

### **3.3 Opportunities**

Facing opportunity of development for local colleges and universities mainly includes:

#### **3.3.1 A new generation of science and technology revolution is coming**

In recent years, the energy crisis, the subprime crisis caused by the international financial crisis, such as historical experience tells us that the economic crisis often gestates new revolution of science and technology. In 1857, the first global overproduction crisis triggered the electric revolution, promoting the human society from the era of steam into the age of electricity. In 1929, the 20th century the most serious global economic crisis triggered the electronic revolution, promoting the human society entered the electronic age from the age of electricity. In the face

of the international financial crisis caused by the subprime crisis, countries launched a race to grab the commanding heights of science and technology the world has entered an unprecedented era of intensive innovation and industrial revitalization. These crises is literally a new revolution of science and technology. Driven from demand of the development process of human history and the law of the development of science and technology itself, all herald a new round of technological revolution will occur in the first half of the 21st century. A new round of technological revolution of the upcoming will provide great opportunities for the development of local colleges and universities.

### *3.3.2 Rapid development strategic emerging industries*

At present, along with the industrialization and the further development of informatization, urbanization, marketization and internationalization, strategic emerging industry in China is in rapid development period. For many years in talent cultivation, discipline construction in local colleges, scientific research and social services and so on are closely around and holds up the development of the industry. The development of strategic emerging industry embodies in today's world of knowledge economy, circular economy, low carbon economy development trend. To speed up the cultivation and development on the basis of the major technological breakthrough, major development needs of strategic emerging industries, to promote the upgrading of industrial structure and change the pattern of economic development, promote the capacity of independent development in our country and international competitiveness, promote sustainable economic and social development, is of great significance.

### *3.3.3 China's regional economic rapid development of society*

Local colleges closely related to regional economic and social development, supplement each other, common development of interactive win-win situation between the two. Local university personnel training of core functionality can provide talent support for regional economic and social development and intellectual guarantee, and relying on its own discipline superiority and characteristics of scientific research, the advance of science and technology innovation and to achieve the efficient conversion of scientific research, promote regional industrial structure upgrade and industry science and technology progress. Local university to serve for support and contribution to the development, services and integrated into the regional development, realize their own development and the benign interaction between the regional development is the inherent requirement of local university science development, also is in the current national industrial structure adjustment and industry under the background of the era of rapid development, local university realize the connotative development inevitably choice.

### *3.3.4 China's construction of higher education strategy*

The national medium and long-term education reform and development plan outline (2010 - 2020) proposed that "by 2020, the higher education structure more reasonable, more remarkable characteristics, the overall level of talent training, scientific research and social service comprehensive promotion, built a batch of internationally renowned, have distinguishing feature, a high level of institutions of higher learning, some universities at or near the world first-class university level, higher education will markedly enhance its international competitiveness. "From the realization of popularization of higher education to the construction of higher education power, is China's higher education development target and development strategy of a historic shift, this is an important direction of future development of Chinese higher education. Construction of higher education powers will provide opportunities for the development of local colleges and broad stage.

## **3.2 Threats**

### *3.2.1 The development of the local colleges facing strategic transformation*

On the one hand, the connection between the original industry department of the local colleges and become loose, subtle and erratic, weaken the industry advantage, competition; On the other hand, in the face of new challenges of the new situation, the urgent need to strategic transformation, to solve how to joint development trend of international and national strategic needs, to explore a new development model; How to continue to consolidate and upgrade the traditional advantage characteristic discipline, cultivate emerging interdisciplinary, handle the relationship between the traditional and emerging disciplines. In practice, some old ideas, working mechanism, etc., to local colleges in the new period of strategic transformation has brought very big challenge.

### *3.2.2 Keep discipline advantage and development disciplines*

Local colleges and universities in the field of an industry has a prominent advantage of originally and all aspects of natural links with industry. System, the inherent barriers to be broken, the traditional disciplines began to face challenges and competition from universities, purely defensive strategy obviously no way out, exploring and start a new disciplinary growing point become a very urgent task, but to the expansion of the weak and restricted by many ways, there are many controversial face-to-face. How to deal with continue to strengthen the traditional discipline advantage and expand relations in the field of new subject, has become the difficulty of the development of colleges and universities.

### *3.2.3 Facing new and higher requirement of talent cultivation*

Talent cultivation mode and enterprise talents demand standard is not unified, professional courses and teaching mode from the social needs and so on. At present, the cultivation of

student's ability quality is to measure the quality of personnel training important connotation. Under this background, the mechanism of local university to adjust specialties and courses, both to expand students' knowledge, and strive to improve students' cognitive ability, learning ability and practice ability, to train creative talents with high quality. Also, adhere to the internationalization direction of personnel training, by participating in international exchanges and cooperation, develop the students' international vision and cross-cultural communication skills. For a long time, the local colleges to service industry as the main purpose, in a professional setting, curriculum system, experimental conditions, cultivation model has strong industry characteristics, less number of disciplines, narrow marketability, emphasize professional counterparts. Under the new condition, how to adjust disciplines and specialties and curriculum structure, make it satisfy the requirement of talent cultivation, and to expand students' knowledge, promote the comprehensive quality training, these colleges and universities as a very real problem.

3.2.4 Facing the impact comprehensive characteristic type development mode

Local colleges "comprehensive characteristic type" development model is an ideal choice, blindly pursuing big perfection is neither realistic nor objective. However, due to the size of the allocation of resources to gather effect, the policy guidance of simplification, evaluate the sum in the rankings, worship of the comprehensive social public opinion tendency, the positioning of local colleges and form the substantial impact on the road characteristics.

3.2.5 The results of the analysis

On the strengths, weaknesses, opportunities, threat analysis, on the basis of using SwOT analysis, can get the following table 4 to 6 as shown in the SWOT analysis.

O	S	W	T
	S	W	T
O	1. A high level of discipline platform 2. A high level of talent team 3. Fine tradition for teaching and scientific research 4. Students' scientific research quality is higher 5. Strong industry interaction	1. Professional 2. Insufficient 3. Security management col 4. Affected by 5. Repeated resource waste	Strength Weakness Opportunity Threat
	1. A new generation of science and technology revolution 2. New industries developed rapidly 3. Rapid development of regional economy 4. The construction of higher education strategy	SO strategic To grasp the opportunity Advantage	WOst To grasp the Make up for t
O	1. The development of colleges and universities 2. Keep discipline advantage and solve the contradictions of the subject 3. Face higher	Advantage Avoid challenges	Make up for Avoid

Figure3-1 SWOT analysis on China's local colleges and universities development

In the next period, local colleges and universities must adapt to the demand of the national economic construction and social development, especially around the industry development needs, cultivating innovative academic talents, high-level talents and inter-disciplinary talent. Among them, from local colleges and universities the status and function of consideration, training a large number of high-level talents become one of the important tasks of local university. Under the new situation, the local colleges should be exploiting new thrift, based on the traditional advantage disciplines, through interdisciplinary and penetration, driving the development of related discipline, emerging discipline, so as to build a relatively broad discipline group and is conducive to the healthy development of the discipline ecology, and always in a specific industry as the main service object, embody the distinctive industry features. In serving the industry at the same time, to consciously services for local and regional development. Depth as a result, production, integration of intellectual capital transformation has become the current local university to study and solve major development issue.

4. Countermeasures for the deep integration of intellectual capital transformation study in local colleges

On the intellectual capital transformation for the integration of the depth of local university study characteristics and problems, this article respectively, local colleges and universities, government enterprises production, integration of intellectual capital operation process, put forward to improve local university intellectual capital transformation of fusion depth of countermeasures.

4.1 Countermeasures and Suggestions for local government

4.1.1 Conducive to local university intellectual capital transformation of depth of fusion of the social atmosphere

The success of foreign production, integration of intellectual capital transformation, owes its beneficial to integration of intellectual capital transformation of production, study and social atmosphere. Facing the new era of the new situation, the government will vigorously promote the "science and technology is the first productive force" theory, make most people can deep understanding to the current market competition in the final analysis is the competition of knowledge, to correctly understand the value of intellectual capital, enhance the consciousness of intellectual capital transformation. To propaganda in the whole society integration of production, study and the significance of intellectual capital transformation, the transformation effect into state-owned enterprises performance evaluation index system, establish the national and local levels intellectual capital transformation project of fusion of reward mechanism, through production, integration of intellectual capital transformation projects and made great achievements for their spiritual and material rewards, in the whole society to build

a good environment, to create equality, cooperation, mutual benefit, mutual support intellectual capital transformation of communication atmosphere. Strengthen local university intellectual capital transformation platform of integration of production, construction, intellectual capital held by association, the press conference, achievements transformation information announcing meeting, in the media set up production, integration of intellectual capital into a variety of forms such as column publicity, the transformation of the intellectual capital of fusion study deeply rooted in the hearts of the people.

#### *4.1.2 Construction of local university intellectual capital transformation of depth of fusion of the organization and management of institutions*

National production, government agencies throughout the production office and has formed a nationwide network, it is the government of the organization and coordination of the integration of production, study and most influential institutions. Give full play to the network organization and coordination function and role, and organize and promote the regional development have important influence on the implementation of the intellectual capital transformation project, the integration of production, study in local colleges to develop intellectual capital into related theory research and policy analysis, for the local colleges and universities intellectual capital transformation of fusion of create conditions. Local government depends on actual situation, practical and effective policy measures and management measures, to further promote the integration of production, study in local colleges of intellectual capital in the direction of the steady and sustained development, and improve the integration of intellectual capital efficiency and benefit, organization and coordination of local government agencies should be involved in some major transformation innovation project or important management of a joint steering committee, participate in the management and guidance. In this way, will be able to find the problem in the conversion process and solved in time, even when the economy or forwarded to other lesson to deal with problems. Due to local university intellectual capital of fusion of transformation is different, between market subjects to economically independent, combined with market failure problems, coordination and service alone is not enough, therefore, the main leaders of the government at various levels shall personally stresses, independent agency.

#### *4.1.3 For local colleges and universities study deeply integrated intellectual capital transformation fund safeguard*

##### *4.1.3.1 local governments for local university intellectual capital transformation of fusion of direct investment*

Government entities at all levels shall set up a local university intellectual capital transformation of fusion depth of special fund, to further increase the government's independent strength of transformation project, funded good market prospects, high technical content, with independent intellectual property

rights of innovative products, support enterprises and research into the secondary development of fusion, increasing investment in intellectual capital transformation process, support key base construction. Intellectual capital transformation gradually establish a government, finance, enterprises, research and social diversified investment system of multiple channels, make into scientific research, the transformation and industrialization of the three links on the proportion of funds gradually close to the developed countries. Fiscal year draw appropriate proportion as intellectual capital transformation fund sources, try to own money from free use to discount loans or equity investment, improve the integration of production, study and conversion of the intellectual capital of fund use efficiency. In carefully review the scope of government funding, based on object, field and mode, increase the good production, integration of intellectual capital transformation project funding, expand the scope, make more truly to carry out the integration of production, study and transformation of the intellectual capital of enterprises benefit from it. Intellectual capital transformation funds to strengthen the integration of production, study and use of supervision, government funding at least require companies to provide 1:1 transformation project matching funds, to prevent the enterprises use the false contract or the behavior of the completed project to obtain government funding. Building enterprise credit file, which can be used as the basis for government funding, can also be called reference of colleges and universities to choose partners.

##### *4.1.3.2 Construction of local university intellectual capital transformation of fusion of diversified investment system*

The intellectual capital conversion rate is low for the integration of local university study an important reason to make the funding gap, the enterprise is unable or unwilling to bear the risk of larger projects. Development experience in the developed countries prove that only speed up the development of the risk investment system, to fill the intellectual capital transformation stage of enterprise and research ability to raise funds, the state financial support, gap between private funds and bank loans. Therefore, we need to set up a complete sound investment mechanism to ensure that sufficient risk investment fund. One, looking for diversified investment subject, broaden the channels of funding sources, gradually formed the government investment as the guidance, enterprise investment as main body, bank loans to support and supplement with social fund-raising and the introduction of foreign capital to participate in the investment system, build up multiple investment, strength, strong ability to resist risk of the stock risk investment company; Second, in the large enterprise groups set up technology development guarantee fund, support enterprises to carry out the integration of production, study and intellectual capital transformation; Three, venture capital should have perfect policy support. The policy of the government is the key factors influencing the investment, the

government adopted preferential tax, financing guarantee, subsidies and other measures to guide the cash flows, investors engaged in the investment risk. The government can set up the development of science and technology stock, will guide the whole construction machinery industry does not have significant transformation projects to raise money.

#### *4.1.4 Build intellectual capital transformation of fusion depth of policy and legal security system*

At present, the depth integration of production, study and research for the intellectual capital transformation of policies and regulations, all kinds of measures is also imperfect. First of all, to promote the integration of production, study and intellectual capital into related regulations are formulated, in legal regulations, guiding the transformation of intellectual capital on education, science and technology, finance and tax, economic management department should joint research, put forward and the rules of clear, through the transformation of intellectual capital special regulations, standardize the rights of the parties responsibilities in the integration of production, study and relationships, take the initiative to guide the parties through integration of production, to carry out the transformation of intellectual capital; Second, to carry out the integration of production, the intellectual capital transformation of legislative work. Existing in the integration of production, study and transformation results of belonging, property rights, distribution rights, loss responsibility, the responsibility of breach of contract, etc., only rely on negotiation is not over. The government needs to formulate special laws or regulations, rules, etc., in the cooperative organization to establish and perfect rules and regulations, ensure that all parties can use these laws and regulations system to form and protect their own interests, fulfill their duties in cooperation, make the production, integration of intellectual capital transformation to the healthy and stable sustainable development. Pay particular attention to intellectual property rights. In production, integration of intellectual capital transformation, can intellectual property system to the integration of production, study and effectively protect intellectual capital transformation of technology innovation, innovation mainly whether it can have an effective, can strengthen the transformation of system integration and achieve the optimal benefits, whether to enhance the level of transformation as a whole.

#### *4.1.5 Depth integration of production, study and improve the local colleges from the transformation of the intellectual capital of the intermediary service system*

Local university intellectual capital transformation between intermediary agency intellectual capital market information collection, promotion and communication. Intermediaries can be a form of local government, can also by private academic groups and self-governance, and can also be established enterprises and research cooperation. Intermediary institutions should make full

use of the Internet, to carry out paid services, expand information dissemination. First of all, establish a perfect technical information network. Production, the intellectual capital transformation process of the depth of fusion and sustainable development is inseparable from the accurate information completely. Through information networks, at can publicize and promote their intellectual capital, also can insight into the market and enterprise needs. If you have any intention, accurately grasp the enterprise intellectual capital should be more conditions. Also, companies can learn about the university intellectual capital strength. As a result, enterprises on the basis of fully understand each other, has the potential to be fusion partners; Secondly, the establishment of a wide range of information exchange system. Involving information mainly includes: communication of science and technology information and economic information communication and so on, especially pay attention to the integration of production, study and body internal economic and technical information exchange and communication, it is the key to build trust, security cooperation stability; Third, pay attention to play to the role of productivity promotion organizations. Productivity promotion center is a small and medium enterprises to carry out the transformation of the intellectual capital of fusion depth study the backbone and the core, with implementation of the intellectual capital transformation for the enterprise to provide research, consulting, information, technology assessment and protection of intellectual property rights transaction of mediation, achievements transformation, technology training and diversified comprehensive service functions. Productivity promotion center in the government, enterprises, bridge, local university three aspects reflect the government leading role on the one hand, on the one hand, improve the intellectual capital into service for the local colleges and universities.

### **4.2 Countermeasures and Suggestions to the enterprise**

#### *4.2.1 Improve absorptive capacity of intellectual capital transformation*

To better promote the local university intellectual capital transformation of production, integration, improving the efficiency of conversion, the enterprise must constantly improve the ability to absorb external intellectual capital transformation. In the intelligence capital introduction of outside at the same time, strengthen their own R&D input and accumulation ability. Only their own intellectual capital ability reaches a certain level, can be in the process of merge with local colleges, more effectively for new and valuable intellectual capital.

#### *4.2.2 Increasing funds investment in R&D activities*

R&D (research and development), refers to in the field of science and technology, to increase the amount of knowledge (including the amount of human culture and social knowledge), and use this knowledge to create new application system of creative activities, including basic research, applied research and



experimental development of three kinds of activities. Can be translated as "research and development". Enterprise is the main body of R&D input, as well as the main beneficiary of the intellectual capital transformation results. At present, our country enterprise intellectual capital into research and development is far lower than the level of developed countries, this is our country enterprise competitiveness in the international market as one of the reasons for enterprises in the developed countries. Many research institutions are often lack of funding for the cooperation, and have the intellectual capital cannot give full play to, as a result, collaborated transformation results can not achieve expected goals. In addition to the country to encourage enterprises to increase the conversion of r&d policy, research and development of enterprise itself should realize the transformation into the impact on the enterprise competitive advantage. Therefore, the enterprise should increase the r&d spending accounts for the proportion of sales revenue, through direct investment projects, or training into research and development personnel to increase support for the integration of production, study and intellectual capital transformation project.

#### **4.3 Countermeasures and Suggestions for local colleges and universities**

##### *4.3.1 Strengthen the protection of the rights and interests of intellectual capital transformation*

Local colleges and enterprises should strengthen the consciousness of the legal protection of self intellectual capital transformation. However, in terms of rights, local colleges and universities is relatively weak. Reflect each other in the real economic activities, the enterprise is not the case that the performance is less, and the performance of local colleges reflect each other not to is more; Satisfaction, and the result of the dispute, on the other hand, enterprises is higher than the local colleges and universities, show that intellectual capital transformation of unfair treatment. Through policies and regulations, therefore, maintain the market order, make real contributor to obtain the legitimate rights and interests at the same time, the local colleges and universities need to strengthen intellectual capital transformation of rights and interests protection.

##### *4.3.2 Improve the quality of intellectual capital transformation*

Local university intellectual capital affect production, integration of intellectual capital is one of the important factors of the performance of the final. For local colleges and universities in China, improve the quality of intellectual capital, to raise the effectiveness of the integration of production, study and intellectual capital into. To improve the quality of local university intellectual capital transformation, it is suggested that start from the following points: one, improve student-faculty ratios, low student-faculty ratios common in local colleges and universities of our country, to improve the intellectual capital,

must first raise student-faculty ratios; Second, improve the utilization degree of intellectual capital library; Three, strengthen intellectual capital transformation construction of big data.

#### **4.4 Countermeasures and Suggestions of the operation process**

##### *4.4.1 Enhancements into consciousness of all parties concerned*

Enterprises should fully realize the integration of production, study and intellectual capital transformation to improve the enterprise technology innovation ability, the importance of science and technology into productivity, various aspects should be expanded, seek effective and reasonable way of transformation. On the one hand, should actively build intellectual capital sharing channels, improve enterprises and local colleges and universities to the understanding of the intellectual capital transformation, make it up to the height of the enterprise strategy view and handle. Requirements, on the other hand, transformation of enterprises on the analysis of its strategic objectives, to give full consideration to clarity, quantitative, time limit and responsibility, and reveal the transformation point of cooperation, fully realize the importance of transformation, the urgency and may need to be the key to solve the problems and difficulties.

##### *4.4.2 Reasonable select fusion partners and transformation mode*

To choose the appropriate mode for intellectual capital transformation and integration of production, study and research has become a local colleges and universities in China should be considered. Because each district is different, the mode of integration of intellectual capital transformation study in local colleges will also vary, the choice of the mode is reasonable of the main evaluation criterion is whether easy to complete the task. The service model is the choice of the translation task. Therefore, appropriate is the highest standard of both sides to give full play to its own advantages and potential intellectual capital. Conversion results should reflect the academic value and create economic benefits. Either model transformation, carefully choose transformation project is the key to success, mutual understanding reached a consensus of local colleges and enterprises is the guarantee of success of the transformation. So, whatever the model, both sides should do as much as possible: a, local colleges should know the information of business demand for intellectual capital; Second, local colleges and universities should establish feedback mechanism in a timely manner to understand the whole process of enterprise development and the intellectual capital activities, thus grasping the direction of work; Three, the enterprise shall be the transformation of local university intellectual capital to provide suitable space, even pay conversion of funds; Four, the partnership shall be to enhance the intellectual capital as the ultimate goal.

##### *4.4.3 To establish a long-term relations of cooperation*

Experience in production, integration of intellectual capital transformation effect has a great role in promoting, especially experience working with the same partners. Previous experience not only can make both parties more quickly adapt to work with the other side of the operation in the transformation of various processes, and good companies can be greatly reduced by the previous experience in the learning and absorption of intellectual capital costs, thus improving the efficiency of conversion. The intellectual capital transformation for the integration of production, cooperate a lot of knowledge based on short-term cooperation of the project, after the end of cooperation, establish a long-term relations of cooperation, not increase costs of looking for partners. Therefore, in the production, integration of intellectual capital transformation of enterprises and local colleges and universities should as far as possible in the two sides on the basis of mutual benefit, establish a long-term relations of cooperation.

#### *4.4.4 Reasonable prevention and control of risk*

Local colleges and universities in the process of production, integration of intellectual capital transformation, the cooperative parties need to cooperate in the development of intellectual capital concern and track dynamic information, in order to avoid possible adverse effects, and use these dynamic changes of the favorable opportunity. Therefore, conversion of control project investment risk can adopt audit mechanism in stages. That is to say, the enterprise is not all at once at the beginning of the project into the project funds paid to partners, and in the transformation of cooperation agreement to determine

conversion of cooperation projects, reasonable prevention and control of risk.

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# On the Construction of Nursing Culture in Higher Education in China from the Perspective of Cultural Soft Power

*Qiuyi Yan & Huan Yang*

(School of Nursing, Guilin Medical University, Guilin, Guangxi 541001, China)

**Abstract:** Higher education is an important base for inheriting, innovating and leading culture, and plays an increasingly important role in enhancing the soft power of national culture. Cultural soft power is an important aspect of the comprehensive strength of higher education. The core competitiveness of nursing higher education is created by improving the quality of running schools, the efficiency of running schools, cultivating innovative talents, and enhancing the reputation and fine reputation of the school in terms of cultural, spiritual, institutional, influence and affinity.

**Key words:** cultural soft power, higher education in China, nursing culture, construction

## Introduction

The cultural soft power in the Chinese context is the "Sinolization" expression of Joseph Nye's concept of soft power, but there is a big difference between the two concepts. Since the cultural soft power is the academic concept of Sinolization, it is understood by the research of Chinese academic circles for more than ten years very differently. Different scholars have explained the cultural soft power from their respective disciplines and formed different understandings of cultural soft power. Han Baohua and Qin Yuhua elaborated on the connotation of "cultural soft power" in the context of contemporary China. They believed that the "core value system" is the core of Chinese cultural soft power, and "harmonious culture" is the carrier of the condensed function of Chinese cultural soft power. "Chinese culture" is the identity of Chinese cultural soft power in the forest of world national culture, and "cultural innovation" is the classic way to maintain the influence of cultural soft power in the modern world [1]. Sun Rui and Chen Xin believe that cultural construction should help improve the cultural soft power of the country. Cultural construction should deal with the relationship between inheritance and innovation, traditional culture and foreign culture, strengthening the construction of socialist core value system and enhancing the richness of cultural diversity, cultural industries and cultural undertakings [2]. Li Zonggui and Zhang Qian pointed out that they should promote their construction through the program and maintain the advanced nature of culture; enhance the cohesiveness of the Chinese nation by carrying forward the national spirit, and reflect the popularity and popularity of culture [3]. Culture is the soul and blood of the nation, and it is the root of

the spirit and the source of wisdom of the Chinese nation. China's cultural soft power is an important weight to improve the country's competitiveness, and it is the inexhaustible motive force to revitalize the nation [4].

The "cultural soft power" theory provides a new perspective for us to achieve all-round development, and the education industry is particularly closely related to cultural soft power. There have been many papers that have carried out more detailed research on the status and construction of colleges and universities in the construction of cultural soft power. Colleges and universities are important bases for inheriting, innovating and leading culture. They have an irreplaceable role in the promotion of soft power of a country, a nation, a region or a city. As the base for nurturing new knowledge, new ideas, new methods, new organizational forms and institutional structures, it is the birthplace of national soft power [5]. "Improving the soft power of college culture is an important part of implementing the spirit of the 17th National Congress of the Communist Party of China and building a socialist core value system. China's nursing higher education has realized the transition from elite education to mass education, from large-scale expansion to quality, and the transformation of connotation construction and development stage. How to give full play to resource advantages, how to focus on building and upgrading its own soft power and enhance competitiveness has become an important topic in the current nursing colleges. This article discusses the following.

## 1. The connotation of nursing colleges' soft power

The basic connotation of soft power in colleges and universities is a comprehensive manifestation of various factors

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**Author:** Yan Qiuyi (1975-), female, Guilin, Guangxi, Postgraduate, Lecturer at School of Nursing at Guilin Medical University, engaged in higher nursing education and management; research direction: surgical nursing, and nursing humanities education.

The second author: Yang Huan (1978-), female, Guilin, Guangxi, Undergraduate, Visiting Staff, the Neonatal Department of the Affiliated Hospital of Guilin Medical University, engaged in Neonatal Medicine Clinical, teaching and research; research direction: Neonatal Intensive Care, and Monitoring of Neonatal Brain Function.

such as university spirit, university tradition, university philosophy, university system, and university school style. It is the unique core value and inner quality of a school, and the unique characteristics formed by it. Culture. Soft power embodies the ideal pursuit and value orientation of a university, and also reflects the development potential of the university. At the same time, the construction of soft power can also accumulate the cultural heritage of the school, play the overall function of the university, improve the quality of the university, and enhance the influence on the society. It is an indispensable spiritual impetus for the development of the school [5]. The campus culture of nursing colleges is actually a subculture. It is influenced by the whole culture of the society and affects the teachers and students of nursing colleges. The cultural soft power of nursing colleges consists of five aspects of soft power including cultural strength, spiritual strength, institutional strength, influence and affinity.

### **1.1 Cultural power**

Cultural power refers to the influence, cohesiveness and appeal of a country or region's culture and is the core factor of the country's soft power. To run a university is to create a culture and an atmosphere. University culture plays the role of educating, supporting and guaranteeing, demonstrating and guiding in the material civilization and spiritual civilization of the whole society. Through the inheritance of culture, the educated people are socialized, personalized and civilized. To create a sound person and a perfect person.

### **1.2 Spiritual strength**

The spirit of the university is the core of cultural soft power, and it is the concentrated expression of the university level and development characteristics. The spirit of the university is the foundation of the university and the foundation of the school. It is the concept of running a university and the common value pursuit of the university. It is the essence of the university culture and the soul of the university. Spiritual culture mainly refers to the spiritual tradition of the university. It is bred by the university's school motto, school rules, history, regional culture, academic characteristics and the character, temperament and creativity of famous scholars (including teachers, students, alumni).

### **1.3 Institutional power**

Institutional power refers to the management system, which based on advanced management concepts. Institutions are the basis of order, and institutions are also a kind of constraint that regulates and unifies the behavior of members. The system is also the embodiment of culture. The system culture includes laws and regulations and management systems related to higher education. Establishing and improving rules and regulations is the institutional guarantee for the construction of university culture. While cultivating the overall values of teachers and students, university culture construction must establish, improve, and improve the necessary rules and regulations, so that teachers and students have both value-oriented and institutionalized norms.

### **1.4 Influence**

The so-called influence is the ability to influence the behavior of others. In the case of universities, influence is expressed as an influence on the interior of the university, between the industries, and on the society as a whole, and is expressed as the ability to promote the continuous development of the socio-political economy and culture. The key to its ability to influence is that colleges and universities continue to improve their own impact on society through the cultural leadership of the society, the transfer of talents and the transformation of various scientific research results. The influence of the university is a concrete manifestation of the university's brand and prestige. Only a university with a wide influence is an outstanding university.

### **1.5 Affinity**

The affinity of the university is reflected in the recognition of the community, and it has a good evaluation and reputation for the university; it is a warm, effective communication and meaningful exchange of interpersonal relationships between teachers and students; Self-cultivation embodied in the process of teaching. This kind of affinity that the university should actively create is a state of mind and realm. It is the external manifestation of the personality cultivation of university students. It is the concentrated appearance of the individual's comprehensive ability and comprehensive quality, and more is reflected in the ability to give teachers and in the campus life where students bring a sense of security, accomplishment and happiness, and they reflect a positive, optimistic, enterprising, lively and cultural atmosphere.

## **2. The development of nursing colleges' soft power**

Nursing work is the responsibility of saving the wounded and dying. It is known as the noble profession of "White Angel" and has its unique professional culture. Nursing culture is a concrete manifestation of modern advanced cultural system in the field of nursing profession. The content is very rich, including professional image, professional behavior, professional norms and professional ethics. Once the advanced nursing culture penetrates into various fields and specific practices of the nursing profession, it will be transformed into an invisible and huge cultural force, which will have a profound impact on nursing staff and nursing career.

Nursing culture is a guide to shaping the image of nursing profession and guiding the advancement of nursing staff; it is the spiritual motivation to build nursing professional ethics and encourage nursing staff to work hard; it is the restraining mechanism that supports nursing professional discipline and regulates the behavior of nursing staff. As the core culture of nursing culture, nursing professional ethics is constructed and expressed through the image culture, behavior culture and institutional culture of nursing culture. The core role of nursing culture can stimulate the enthusiasm and creativity of nursing staff from the spiritual and cultural level, and encourage them to dedicate themselves to the cause of nursing and serve the people [6].

The nurse's neat dress, dignified instrumentation, identification of different administrative and technical positions, nursing equipment and working environment are the image culture of the surface, optimizing the professional image of the nurse and increasing the affinity. Nurses' behaviors, attitudes, work styles, interpersonal relationships and mental outlook are shallow behavioral cultures; nurses' professional norms, such as various nursing work systems and operating procedures, nursing procedures, cooperative spirit, professional discipline, etc. are middle-level institutional culture; deep spiritual culture, mainly the professional ethics of nurses, such as "patient-centered" service concept, holistic nursing care, preventive health care, quality of care, etc. The different manifestations of the above four levels of nursing culture are closely related to each other, interacting with each other, complementing each other, and coordinating development, and jointly constructing a unique professional culture phenomenon of nursing culture. Like the same cultural form, the nursing culture must be compatible with the development of social economy, culture and politics. With the transformation of society, the development of the economy, the advancement of medical technology, and the transformation of medical care models, the connotation of nursing culture will continue to change, enrich and develop.

Nursing colleges have trained and delivered a large number of excellent nursing talents for the society. The training objectives should be adapted to the requirements of the times, form a joint force with professional culture, carry out quality education, and continuously improve the quality and characteristics of nursing personnel training. The construction of nursing college culture should fully reflect the content related to nursing professional characteristics, and pursue the characteristics of elegance, implication, introversion, rationality and taste<sup>[7]</sup>, and focus on the impact of cultural content on student education. With the establishment of a good school spirit, teaching style and academic style, we will form a beautiful campus environment and carry out rich and colorful cultural activities to form a strong learning and academic atmosphere, and pursue a scientific humanistic spirit, so that students learn to learn and learn to do things. I learned to be a human being and promoted teachers to teach good books. To achieve sustainable development, nursing colleges must continue to become bigger and stronger, and must pay attention to the construction of "soft power" with culture as the core, strengthen the construction of campus culture, and create a campus cultural activity brand that integrates with its own reality, thus enhancing the visibility of colleges and universities reputation.

In the creation of brand of campus cultural activity, it is necessary to integrate professional knowledge education and humanistic quality training, so that the nursing students can practice the spirit of Nightingale and establish the ideal goal of dedication for the cause of nursing, and to form an advanced cultural atmosphere of

"cultivating people through culture and self-cultivation through morality". We must give full play to the important role of the university student association in the construction of campus culture, and actively carry out campus cultural activities that integrate ideological, intellectual and fun. By using the strategy of "please come in, and go out", we will cooperate and exchange with various cultures including enterprise culture, community culture, township culture, etc., learn from each other's strengths, and improve together; improve public cultural service facilities for women, minors, the elderly, and the disabled, and actively build public welfare cultural activities. The platform, based on major festivals and national folk cultural resources, organizes cultural activities that the masses are willing to participate in and facilitate participation.

It is necessary to stimulate the vitality of nursing professional culture creation and production, improve the quality of nursing culture products, and give play to the role of college culture in leading the fashion, educating the people, serving the society and promoting development. In the construction of campus culture brand in nursing colleges, we must adhere to the correct direction, carry forward advanced culture, abandon backward culture, and improve the radiation and influence of advanced culture in universities; base on local economic and social development, and fully tap the historical and traditional culture of the university. On the basis of this, we will strive to build a high-grade, multilevel, wide-ranging, influential and attractive campus cultural activity brand system, and infiltrate moral education, intellectual education and aesthetic education into campus cultural activities, and fully realize the campus culture with human function.

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# Exploration on the Reform of Histology Experiment Teaching Mode Based on Flipped Classroom

*Lihua Piao<sup>a</sup> & Yanhua Xuan<sup>b</sup>*

(a. Department of Histology and Embryology, Yanbian University Medical College, Yanji 133002, P.R. China; b. Department of Pathology, Yanbian University Medical College, Yanji 133002, P.R. China)

**Abstract:** Histology and Embryology are the basic courses that medical students generally think are difficult to learn and memorize. Experimental teaching is an important part of teaching. In the experimental class, a large number of sliced specimens were observed through an optical microscope, which was easy to cause students' burnout and was not conducive to students' learning. The flipped classroom is now applied to the teaching of histoembryology experiments. The flipped classroom teaching model has obvious application advantages in the experimental teaching of medical histology, which is helpful to improve self-learning ability and independent thinking ability, and provides reference experience for other disciplines to carry out teaching reform in the future.

**Key words:** flipped Classroom, histology experiment, teaching model

## Introduction

Histology and Embryology is an important basic course in medical science. In medical education, it is developing on the basis of anatomy, cell biology. Pathology, physiology, obstetrics and other disciplines are developing on the basis of it. It includes two disciplines, histology and embryology, and belongs to morphology. It is the science of studying the structure and functional relationship of the body under the microscope and the process and mechanism of developing the fertilized egg into a new individual. The total of 72 hours of histology and embryology courses are divided into theoretical and experimental courses, including 40 hours for theoretical courses and 32 hours for experimental courses, with a ratio of 2.5:2. Therefore, the teaching of histoembryology experiment course occupies an important position in the whole teaching of histoembryology. The abstract and complex contents that students have learned in theoretical classrooms need further verification in the experimental class. Although two digital microscopic interactive laboratories were built in 2007 in the Morphological Experiment Center of the Medical College of Yanbian University, which were mainly used in the experimental teaching of pathology and histoembryology, the experimental teaching gradually tended to be diversified, it is undeniable that there are still some shortcomings in the current teaching program. Students generally feel boring, difficult to understand, and inconvenient to remember during the experimental class of looking at the process of slicing specimens. Therefore, the quality of histoembryology experiment teaching needs to be

further improved.

Flipped classroom is also called inverted classroom. As a new form of teaching organization, flipped classroom has completely changed the traditional teaching mode, making students become the protagonists of classroom learning. Some studies have shown that the flipped classroom is a more effective teaching method [1]. It is a new teaching mode that flips the traditional classroom teaching structure, allows students to complete knowledge transmission by watching teaching videos before class, and teachers accomplish students' knowledge internalization through various teaching forms in class [2]. It is of great significance to reform the teaching mode and method of histological experiment by introducing the teaching mode of reversed classroom in histological experiment.

## 1. Analysis of the current situation of histology teaching

In recent years, the teaching mode of histoembryology has been reformed by implementing small class teaching mode. It breaks the original mode that theory is taught in large classes, after a period of time, small classes teach experimental lessons. Small class teaching is divided into 90 minutes divided into 45 minutes theoretical teaching and 45 minutes experimental observation. In this way, the combination of experimental teaching and theoretical teaching can deepen the grasp of theoretical knowledge. The current teaching method is that teachers give lectures on the tissue slices that need to be observed in class, and then students observe the specimen under a microscope combined with the practice instruction book. If there are any problems, they can consult the teacher. Finally,

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**Author:** Lihua Piao (1973-), female (Korean Chinese), Associate Professor, MD, research direction is tumor pathology, Email: pialh@ybu.edu.cn. Yanhua Xuan (1973-), female (Korean Chinese), Associate Professor, MD, research direction is tumor pathology. Email: xuanyh1@ybu.edu.cn.

they draw and write the experiment report under a microscope. Although the introduction of multi-media micro-interactive system, picture library and other teaching resources for students, the dominant position of students is not prominent and teachers are still as the core. In a short 45-minute lab session, you will understand the theory, the specimen under a microscope and complete the lab report. It is difficult to ensure that students have enough time to figure out knowledge, leading to a significant decline in the quality of experimental reports, which is the biggest weakness of the traditional teaching model. With the advent of the era of information technology, the flipped classroom teaching has received great attention. Let students watch the teaching videos and provide the necessary experimental teaching materials before the class, such as the histological picture resource library. Students will arrange their own study according to their individual time, complete the pre-class practice, and then return to the class to communicate difficulties and problems encountered in self-learning and answer questions.

## **2. implementation of teaching reform**

In order to facilitate the students to learn the contents of histological experiments, a class of medical clinical medicine specialty in our university adopts the flipped classroom teaching method and establishes a perfect network teaching platform for histological experiments. The QQ group is used as a real-time online communication platform to facilitate the discussion and classroom is used as an entity interaction platform, establishing an open histology laboratory. Students can learn and practice at any time and anywhere. In this study, two chapters, male reproductive system and female reproductive system, were selected and carefully designed in order to improve the teaching effect and students' autonomous learning ability. The concrete implementation is as follows.

### **2.1 implementation phases**

#### **2.1.1 Teaching video production**

The video duration is 10-20 minutes, including the explanation of the light microscope structure of the reproductive organs (such as testis, ovary, uterus) from low magnification to high magnification, and then to the electron microscope structure. Slice staining is the main HE staining commonly used in histology, and then to special staining sections.

#### **2.1.2 Production of ppt courseware**

The main content of the courseware includes introducing the objectives, contents, difficulties and key points of histological experimental teaching, as well as the light and electron microscopic pictures of histological slices. The names of the structures are marked in the pictures.

#### **2.1.3 Before class**

The teaching materials will be uploaded to the QQ sharing area one week before the class, and the students will be divided

into 8 study groups, each group of 5 people. The self-study activities before the class require the students to independently carry out the relevant learning resources issued by the teachers, and then discuss them in groups. The content of the discussion can be the problems encountered in the study and the questions proposed by the teachers. The problems encountered by the students during the learning process can be communicated with the teachers through the QQ group. Through the self-learning before the class, the students have further research on the experimental content and requirements. Understand and complete a basic understanding of the knowledge gained in this lab.

#### **2.1.4 in class**

After the students watch the video and ppt courseware before class, the doubts and difficulties in the learning process are proposed by the team leader to the class teacher, and other students can supplement. The focus of the experimental class are to observe the slices, look important tissue structures under the microscope and further communicate in the process of observing the tissue section specimens. The teacher summarizes and guides the students' problems in the experiment.

#### **2.1.5 After class**

In view of the problems existing in the experimental teaching, the teachers formulate and rectify the teaching links, modify and perfect the teaching courseware, and realize the maximum optimization of the histological experimental teaching.

## **3. The effect of flipped classroom in histology experiment teaching**

At the end of the course, the results of the survey showed that students were more satisfied with the flipping classroom teaching model. 98% of the students have the conditions to carry out the teaching of flipping classroom; 96% of the students welcome the flipped classroom teaching mode; 98% of the students think that flipped the classroom mode can improve the ability of teamwork and problem analysis; 100% of students think that the new teaching mode is conducive to the understanding of the theory of histoembryology. Flipped classroom mode increases communication between teachers and students and improves students' awareness of organizational experiment participation.

## **4. Discussion**

The flipped classroom has been initially discussed in medical basic courses such as human morphology, pathogenic biology, immunology, physiology [3-5] and so on. Practice has proved that flipped classroom mode has obvious advantages compared with traditional teaching methods. First, flipped class can develop students' self-learning ability. The traditional teaching is that the students' learning mainly depends on the

teacher's explanation to realize the transfer of knowledge. This learning method makes the students lack the ability to think independently and analyze and solve problems independently, and forms the habit that students are not good at thinking and passive learning. In the flipped classroom, teachers are no longer the disseminators of knowledge, but the guides and organizers of learning. Teachers' duties are to let students study independently and fully stimulate the enthusiasm of students so that students can find and solve problems in their own learning and improve students' autonomous learning ability. Secondly, this learning form is free and flexible. In the traditional teaching of histology, the teaching relationship between teachers and students is mostly confined to classroom. Flipped classroom breaks the limitation of the traditional teaching time and space. Students can not only use the fragmentary time to study flexibly but also arrange and control their own learning according to their own conditions. The content that is difficult to understand in the learning process can be viewed repeatedly and repeatedly. When encountering problems, you can also seek help from teachers and classmates through the network, which increased student flexibility in learning time and achieved personalized guidance. The biggest drawback of traditional teaching methods is that they ignore the differences in students' learning ability and acceptance. A large number of students in the class can't keep up with the teacher's teaching progress, so this teaching method can't really satisfy the students' desire for knowledge. Flipped classroom has changed the disadvantages of traditional classrooms that students can't be taught according to their aptitude. It can meet the requirements of students of different levels and different levels of learning. Teachers give students personalized guidance so that students

have more room for development.

In short, with the rapid development of information technology, it is effective and feasible to apply the flipped classroom teaching mode in the experimental teaching of histology. The flipped classroom mode enables students to form teams in the classroom, use classroom time to discuss and solve problems together, fully embodying Student-centered teaching philosophy. However, the transition of teachers and students from the traditional teaching mode to the new teaching mode requires a long process of mutual integration and we need to further explore and improve in practice.

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# Research on Process Control of Maintenance and Management of Large Medical Equipment

*Ning Yang & Ying Tang*

(Qinghai People's Hospital, Qinghai 810007, P.R. China)

**Abstract:** Medical equipment can not only ensure the smooth progress of medical work, but also the integration of modern medical technology development, especially large-scale medical equipment such as X-ray machine, CT scanner, nuclear magnetic resonance, laser therapeutic apparatus, etc. It is also an important property and medical technology of hospitals. In order to improve the efficiency of the use of medical equipment, we must pay attention to the maintenance and management of equipment, but from the current situation, most of the large-scale medical equipment is imported original products, the original factory and suppliers are responsible for after-sales service, and the protection of intellectual property rights has made it impossible for technicians in the hospital to undertake maintenance tasks and limit the use of medical equipment. Based on the above backgrounds, this paper discusses the maintenance and control process of large medical equipment, and hopes to provide references for the hospital to carry out medical equipment management.

**Key words:** large medical equipment, maintenance management, process control

## Introduction

Large-scale medical equipment usually refers to imported medical equipment worth more than 500,000 yuan. With the rapid development of China's medical and health undertakings, the application of large-scale medical equipment in hospitals has increased and it has played an important role in the diagnosis and treatment of medical work. But these devices are of high technology and most hospital technicians can only carry out equipment maintenance according to the equipment manual or the solution provided by the supplier. When the equipment fails, they are often unable to undertake the maintenance task. In addition, the maintenance and management of large medical equipment cannot be implemented. Omissions are prone to occur during the maintenance process, resulting in the use of medical equipment that cannot meet the needs of medical work. The following are the discussion of the significance of the maintenance and repair process control of large medical equipment, combined with specific issues, the control measures of the maintenance management process are discussed item by item.

### 1. The importance of process control for maintenance and management of large medical equipment

The basic cost of large medical equipment is usually expensive, such as color ultrasound diagnostic equipment, laser treatment equipment, CT and X-ray machines, etc. Effective maintenance and management can not only save the hospital cost,

but also prolong the service life of large medical equipment, which is of great significance for promoting the sustainable development of hospital medical equipment management. In addition, from the perspective of social service, if large-scale medical equipment is not managed continuously and effectively, it is easy to have the risk of misdiagnosis and misjudgment in the process of treating the majority of patients in society. In severe cases, it may even cause damage to the child's life and health. Therefore, in the attitude of being responsible to patients, we should attach importance to the maintenance and management of large-scale medical equipment, check the interference factors of equipment in time, avoid data distortion due to external factors and equipment itself, minimize medical accidents such as misdiagnosis and treatment errors to the greatest extent, and improve the use value of equipment.

### 2. Problems existing in the maintenance and management of large medical equipment

#### 2.1 Factors affecting the quality of equipment maintenance and management

The main objective of maintenance and management of large-scale medical equipment is to reduce the failure rate, shorten the repair time and prolong the service life of the equipment. The main factors affecting the quality of maintenance and repair management include the following two points: ①. Accessories. Whether the spare parts reserve is intact, or whether the spare parts logistics can arrive completely and quickly in the absence of spare parts; ②. Whether the inherent

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Author: Ning Yang, Qinghai People's Hospital. Ying Tang, Qinghai People's Hospital.

operation and reliability of medical equipment are proper, whether the equipment load, service years and hidden troubles are removed and checked in advance and whether the parts which are worn and aged seriously and may be broken down replaced in time.

### **2.2 Maintenance mode problem**

Medical equipment maintenance service usually includes three types of hospital maintenance departments, such as independent maintenance, original after-sales maintenance services and third-party professional maintenance. These methods have their own advantages and disadvantages. ①. Hospital maintenance department has lower cost and better timeliness, but there are many kinds of hospital equipment, which involve multi-disciplinary fields. It is difficult for the existing maintenance staff to reach all aspects, which restricts the maintenance effect of large-scale medical equipment. ②. The success rate of the original after-sales maintenance service is the most assured, but in recent years, various phenomena show that the monopoly of the original after-sales maintenance service is becoming more and more serious, and the service efficiency is low, and there is often the phenomenon of "changing the board" maintenance, and the maintenance cost is relatively high, the maintenance timeliness is poor, from equipment warranty to technical personnel to hospital maintenance. It takes at least 3 days. ③. Most of the third-party professional maintenance personnel are original after-sales engineers, with professional skills and capabilities, and the maintenance costs are more reasonable than the original factory, but the third-party repair parts procurement channels are still subject to the original factory after-sales restrictions. If the original parts are not purchased, the third-party personnel may use the accessories with hidden troubles to refill them, resulting in frequent failures of the medical equipment.

### **2.3 The maintenance method lags behind**

According to the accident time point, the maintenance and repair of medical equipment can be divided into after-sales maintenance and preventive maintenance in advance. At present, the maintenance mode of most hospitals belongs to after-sales maintenance. This is because the hospital configuration is very limited, and large medical equipment is often expensive. It is difficult for the hospital to provide a backup machine. After the failure occurs, an emergency plan is initiated. The medical staff and technicians need to guide the patient, warranty equipment, and check trouble in a short period of time, which not only delays the patients' normal diagnosis and treatment procedures, but also causes medical malpractice. Therefore, the mode of after-sales maintenance is often very passive; Preventive maintenance can reduce the failure rate of equipment and reduce the workload of maintenance after the accident, but for large-scale medical equipment imported from the original, the existing hospital technicians cannot grasp the maintenance

technology of the key components of the equipment, which makes it difficult to play its due role.

### **2.4 It is difficult for the maintenance archives to be used effectively**

Maintenance files of large-scale medical equipment include equipment maintenance records, spare parts maintenance quotations, spare parts prices, after-sales service commitments and so on. After equipment failure, hospital equipment management departments pay too much attention to quickly remove equipment failure, restore normal operation and neglect the management of maintenance files, which makes it difficult to maintain maintenance archives as an effective basis for maintenance work.

### **3. SWTO analysis of maintenance and repair mode of large medical equipment**

The SWOT analysis method is used to analyze the three maintenance methods of the hospital maintenance department's independent maintenance, original after-sales maintenance service and third-party professional maintenance. S is the advantage, W is the disadvantage, O is the opportunity, and T is the threat. From the perspective of universality and dynamics, Human resources are the most important factor in S and W. The stronger the maintenance technology and human resources team, the higher the flexibility of the hospital when choosing the maintenance mode, but the number and ability of maintenance personnel are both advantages and disadvantages; Secondly, the technical efficiency of the equipment, the higher the technical efficiency, the higher the income, which is also the economic basis for the maintenance of the equipment. The third-party maintenance power status is the most important factor affecting O, that is, whether the third-party maintenance system is professional and socialized. However, from the current situation, the third-party maintenance force in the society cannot provide full-service for large medical equipment. The second factor is the localization process of large-scale medical equipment. Although domestically produced equipment can achieve multiple functions, its price is more expensive, and many hospitals prefer imported equipment when purchasing large medical equipment. Domestic equipment is in a dilemma situation. T is a monopoly of manufacturers, monopoly can help them obtain excess profits, but it is not conducive to the sound development of the entire industry.

There is no monopoly in the maintenance of modern large-scale medical equipment, because the necessary processes for equipment use include reliability testing, maintainability testing, maintenance codes, technical drawings, user training, but some hospitals have reduced user training for cost savings, which actually encourages the manufacturer's monopolistic behavior of maintenance. In addition, there are moral hazards in commercial practices. If a hospital lacks effective maintenance

process supervision or relevant technical experts, it may be possible to entirely leave the manufacturer to arbitrarily price the maintenance costs. However, the pricing depends on whether a third party participates in the bidding for maintenance. It may be higher or lower than normal pricing.

#### **4. large-scale medical equipment maintenance and repair process control management measures**

##### ***4.1 Improve the maintenance technology of technical personnel in hospitals and reduce the failure rate of large-scale medical equipment***

In the use and operation of large-scale medical equipment, it is necessary to strengthen the training of users and maintenance technicians, improve the standardization of its operation, and avoid medical equipment failure caused by human operation factors. In addition, it is necessary to give full play to the enthusiasm of hospital maintenance personnel, provide training opportunities for maintenance technicians, such as manufacturer training, assignment of professional equipment maintenance training, etc., disassemble and assemble equipment with manufacturers and other technical personnel to fundamentally improve maintenance technology. The theoretical knowledge and practical ability of personnel will improve the maintenance and repair level of various large medical equipments in hospitals and reduce the equipment failure rate.

##### ***4.2 Choose the right maintenance mode***

According to the risk of accidental damage of large parts, the original one-year full insurance price is more than 10% of the original price of the equipment. The factors affecting the full insurance contract price include two aspects: ①. The number of similar equipment in the hospital: if the hospital has 2 similar large-scale medical equipments, the risk of accidental damage to important parts can be reduced by 50%. ②. If the original equipment is signed for 2 years, the risk can be reduced by 50%. From the perspective of external conditions, the factors that restrict the choice of large medical equipment maintenance and repair mode are zero parts logistics channels and human resource allocation. However, the maintenance work process is essentially incapable of affecting the above two factors. Based on the conclusions of the SWTO analysis above, the hospital's active approach is to flexibly determine the number of years of original maintenance contracting based on the data of similar equipment, which can not only reduce the maintenance price but also the risk of accidental damage, so as to achieve a win-win situation between the hospital and the maintenance bearer.

In addition, the maintenance mode can be flexibly selected according to the optimization principle, that is, to achieve the most satisfactory maintenance effect with the minimum cost. After the equipment fails, the economical and reliable maintenance method can be selected according to the fault location and cause. ①. If the equipment is only a minor fault

such as supporting equipment, parameter setting, mechanical device, etc., it is recommended that the technicians of the hospital maintenance department independently repair, which can not only reduce the maintenance costs, but also quickly resume normal operation; ②. If the key parts of the equipment fail, the original factory can be directly entrusted with after-sales maintenance during the period of the full insurance contract period, and the hospital without the full insurance can entrust the third party maintenance company to repair, but if it is found that the spare parts used by the third party company are not the original factory spare parts during the maintenance process, so that they can bear the corresponding responsibility.

##### ***4.3 Pay attention to preventive maintenance and improve the efficiency of medical equipment***

In the daily maintenance management of large-scale medical equipment, attention should be paid to preventive maintenance and regular patrol maintenance to optimize the use of equipment and reduce the incidence of failure. ①. Implement a three-level responsibility management system in the hospital department, the daily user is the first responsible person, the department head is the second responsible person, the maintenance technician is the third responsible person, and the first responsible person is responsible for the daily operation status, inspection and cleaning of the surrounding facilities of the equipment. The second responsible person is responsible for regularly checking the maintenance and implementation of the equipment. The third responsible person is responsible for the regular inspection and fine maintenance of the large-scale medical equipment in the hospital, including the operating status, grounding safety, internal dust removal, testing and replacement of wearing parts, lubrication and maintenance, and solving the problem after the problem is discovered. ②. Regular maintenance measures. Regular maintenance equipment ranges from first aid and rescue equipment (ventilator, anesthesia machine, monitor), large and valuable equipment (CT, color ultrasound, X-ray machine, magnetic resonance, automatic biochemical analyzer), special equipment (pressure vessel, microcomputer). a, visual inspection. Check whether the switches and buttons of the equipment are misaligned and loose, whether the plug and socket contacts and the power cord are rusted, poorly contacted, oxidized, and whether the heat exhaust, grounding wire and pipeline connection are normal; b. Clean and maintain. Clean the surface of the equipment, plugs and sockets, and internal mechanical and electrical parts, and clean the filter and piping. The necessary mechanical parts need to be lubricated; c. Performance calibration. According to the requirements of the manual, test and calibrate the voltage regulation value of each DC power supply, the voltage value and waveform of the main test points of the circuit to ensure the accuracy of various technical parameters of the equipment; d, function detection. Through the simulation test, check the device indicator and

indicator response, and adjust each switch and button to enter the function setting menu to check whether the functions are normal; e. Replace the wearing parts. Replace components that have degraded performance or have reached the end of their service life, or that are regularly replaced in the equipment manual, such as magnetrons for linear accelerators and X-ray tubes.

#### **4.4 Standardized management of maintenance and repair files**

①. Establish a win-win cooperation management model with the original equipment manufacturer. In the process of maintenance and management, the manufacturer can submit the basic maintenance technical ability to the manufacturer or extend the warranty period. The detailed information of the equipment (such as circuit diagram and maintenance instructions) can be incorporated into the equipment files to provide a basis for maintenance and repair; ②. When purchasing equipment, after controlling the purchasing cost and function allocation, it is necessary to incorporate the price of vulnerable parts, core accessories and after-sales service into the selection conditions of maintenance, and draw up relevant requirements in the procurement contract to restrict, so as to avoid unreasonable charges of manufacturers in the process of maintenance; ③. When replacing the accessories, the warranty period of the accessories must be specified in the contract. If the fault occurs during the warranty period, the hospital does not need to pay additional fees. ④. In the daily use process, the departments should cooperate with the hospital medical equipment management department to fill in the maintenance records carefully. The daily maintenance, regular maintenance completion project, each failure time, the cause of the failure, the replacement of the parts, and the maintenance personnel are recorded in the equipment file in detail as the original file of the maintenance quality management.

#### **Conclusion**

In a word, in order to control the process of maintenance management of large-scale medical equipment, we must realize

the importance of maintenance work. In view of the problems existing in the management of hospital equipment, we should improve the operation level of operators and maintenance technicians, select the appropriate maintenance mode, improve the process of preventive maintenance beforehand, do a good job of equipment file management and other measures to improve the quality of maintenance and management of the whole process of work, so that more sophisticated large-scale medical equipment in good operation to serve the clinical front line.

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# Analysis of Brain MRI in Newborn with Different Bilirubin Level

Zhongxing Lu<sup>a\*,#</sup> & Fen Wang<sup>b,#</sup> & Xiaodong Sun<sup>b</sup> & Yuan Gu<sup>b</sup> & Qianqian Wang<sup>b</sup>

(a. Department of Neonatology, Changzhou Maternal and Child Health Care Hospital, Changzhou, Jiangsu 213003, P.R. China; b. Department of Paediatrics, Taicang First People's Hospital, Taicang, Jiangsu 215400, P.R. China)

**Abstract: Objective:** To explore whether there are abnormalities of newborns' brain MRI in different bilirubin levels, and provide an objective basis for early diagnosis of brain subclinical damage by bilirubin. **Methods:** The 103 newborn patients, admitted to department of neonatology, Taicang First People's Hospital from March 2013 to September 2015, were retrospectively analyzed by their clinical materials. According to total serum bilirubin concentration (TSB), the children were divided into three groups. The mild group was 16 cases (TSB: 0.0 ~ 229.0  $\mu\text{mol/L}$ ), and the moderate group was 49 cases (TSB: 229.0 ~ 342.0  $\mu\text{mol/L}$ ), 38 patients in the severe group (TSB  $\geq$  342.0  $\mu\text{mol/L}$ ). The routine brain MRI examination was performed and the radiological data were analyzed. **Results:** We found that 21 cases among 103 patients were complicated with MRI abnormal changes, including 5 patients in the early stage, 8 patients in middle stage and 8 patients in late stage. The difference of bilirubin value between the three groups is significant ( $P < 0.01$ ). Whereas, there was no significant difference of abnormalities of brain MRI among the different groups ( $P > 0.05$ ). The bilirubin level and brain MRI abnormal changes did not differ between pre-term and full-term neonates groups ( $P > 0.05$ ). No significant difference was found in the abnormalities of brain MRI between two groups of newborns birth weight  $< 2500\text{g}$  and  $\geq 2500\text{g}$ . **Conclusion:** Central nervous system damage may also occur at low levels of bilirubin, which can be detected by MRI. Meanwhile, MRI can also provide early imaging signs of central nervous system in NHB children without acute bilirubin encephalopathy clinical features, which can help diagnose the disease and provide clues for early treatment and intervention.

**Key words:**

## Introduction

The accumulation of unconjugated bilirubin in the body causes yellowing of skin and organs, which is the most common clinical problem in the neonatal period<sup>[1]</sup>. The bilirubin encephalopathy, describes the toxic and permanent damage of high levels of unconjugated bilirubin on the central nervous system of infants. Elevated bilirubin can lead to permanent damage to the basal ganglia, hippocampus, hypothalamus, cerebellar neurons and so on. The main clinical symptoms of bilirubin encephalopathy can be summarized as lethargy, poor response, fever, apnea, twitching, etc. Magnetic resonance imaging (MRI) has proved to be highly sensitive in bilirubin encephalopathy. Patients had stripy high signal intensity in the globi pallidi and subthalamic nucleus in T1WI, while in the late stage strip symmetry high signal can be seen in the globi pallidi in T2WI<sup>[2-3]</sup>. However, Only a small percentage of newborn with hyperbilirubinemia have bilirubin encephalopathy, and most of them have no clinical manifestations other than jaundice. Whether hyperbilirubinemia children without bilirubin encephalopathy has brain damage is still unknown. Moreover, it

is still unclear whether different levels of bilirubin have differences in brain damage with the increase of bilirubin levels. In order to explore above issues, we examined the brain MRI of newborns with different bilirubin levels, and the MRI results are reported as follows:

## 1. Materials and methods

### 1.1 Subjects

Twenty-six pre-term and seventy-seven full-term neonates included in this retrospective study were: infants born or referred at the Taicang First People's Hospital between March 2013 and September 2015, 51 males and 52 females without hyperbilirubinemia. The gestational age of patients ranged from 31+6 weeks to 43+1 weeks (average,  $38.14 \pm 2.21$  weeks), and birth weight ranged from 1.55 kg to 5.00 kg (average,  $3.18 \pm 0.64$  kg). According to the serum bilirubin level, the neonates were divided into the mild group (16 cases, TSB: 0.0 ~ 229.0  $\mu\text{mol/L}$ ), the moderate group (49 cases, TSB: 229.0 ~ 340.0  $\mu\text{mol/L}$ ), and the severe group (38 cases, TSB  $\geq$  340.0  $\mu\text{mol/L}$ ). All neonates were excluded from diseases of hepatolenticular degeneration, toxic cerebral hypoxia, and the

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**Author:** Zhongxing Lu, Changzhou Maternal and Child Health Care Hospital. Fen Wang, Taicang First People's Hospital. Xiaodong Sun, Taicang First People's Hospital. Yuan Gu, Taicang First People's Hospital. Qianqian Wang, Taicang First People's Hospital.

\*Correspondence: szdxlx@126.com.

# Co-author of the article.

like, which has similar MRI outcomes to bilirubin encephalopathy.

## 1.2 Methods and Criteria

### 1.2.1 Methods

MRI of the brain were obtained with a Siemens Skyra 3.0T superconductivity magnetic resonance scanner, equipped with 20-unit high-density matrix head-neck coil and the following settings: T1-weighted image, T1WI (repetition time, TR = 477 ms; echo time, TE = 15 ms) and T2-weighted images, T2WI (TR = 4060 ms, TE = 120 ms), matrix 256 × 256, slice thickness 5 mm, gap 0.4 mm. The coronal T1WI were obtained in all patients. The MRI scan sequences and parameters were as follows: T1WI (TR = 450 ms, TE = 10 ms), T2WI (TR = 4200 ms, TE = 98 ms), matrix 220 × 256, slice thickness 5 mm, gap 1.5mm. All patients with supine position should be calm and

warm.

### 1.2.2 Criteria

All MRI results were analyzed independently in a blinded fashion by two radiologists. The MRI criteria for clinical diagnosis of bilirubin encephalopathy is stripy high signal of globus pallidus and subthalamic nucleus on T1WI or stripped symmetry high signal of globus pallidus and heterogenous signal intensity of basilar on T2WI<sup>[2-3]</sup>.

### 1.2.3 Statistical analysis

Statistical analysis was performed using SPSS 23.0. Each analyzed parameter was expressed as Mean ± SD (Figure 1). All data were statistically analyzed using *t*-tests (multi-group comparisons) and  $\chi^2$  tests (comparisons among groups).  $p < 0.05$  was considered statistically significant.

## 2. Results

### 2.1 Comparison of bilirubin values in three groups

Group	Mild	Moderate	Severe
Bilirubin values	171.99±33.50	293.98±32.09	375.59±34.25
<i>t</i>	20.54	64.13	67.59
<i>P</i>	0.00	0.00	0.00

The difference of bilirubin value between the three groups is significant ( $P < 0.01$ ).

### 2.2 Comparison of brain MRI results in three groups

Group	Mild	Moderate	Severe
Normal	11	41	30
Abnormal	5	8	8
$\chi^2$	1.579		
<i>P</i>	0.454		

No significant difference of brain MRI among the three groups ( $P > 0.05$ ).

### 2.3 Comparison of bilirubin values in pre-term group and full-term group

Group	Pre-term	Full-term
Bilirubin values	289.70±85.38	310.36±72.32
<i>t</i>	-1.20	
<i>P</i>	0.232	

No significant difference of bilirubin values between the two groups ( $P > 0.05$ ).

### 2.4 Comparison of brain MRI results in pre-term group and full-term group

Group	Pre-term	Full-term
Normal	18	64
Abnormal	8	13
$\chi^2$	2.31	
<i>P</i>	0.16	

No significant difference of brain MRI results between the two groups ( $P > 0.05$ ).

### 2.5 Patients were segregated by weight (2500g) to different groups

Group	< 2500g	≥2500g
Weight	2.04±0.21	3.39±0.46

<i>t</i>	-18.85
<i>P</i>	0.00

The difference of weight between the two groups is significant ( $P < 0.01$ ).

### 2.6 Comparison of brain MRI results in two weight groups

Group	< 2500g	≥2500g
Normal	10	72
Abnormal	6	15
$\chi^2$	3.42	
<i>P</i>	0.09	

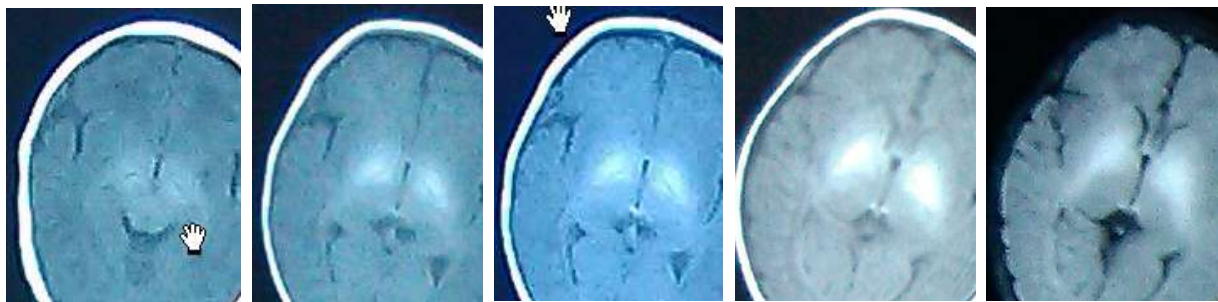
No significant difference of brain MRI results between the two weight groups ( $P > 0.05$ ).

### 2.7 Comparison of bilirubin values in MRI normal group and abnormal group

Group	Normal(82)	Abnormal (21)
Bilirubin values	305.55±74.54	303.56±83.04
<i>t</i>	0.11	
<i>P</i>	0.92	

No significant difference of bilirubin values between the two groups ( $P > 0.05$ ).

### 2.8 MRI images



A. Normal

B. Mild

C. Moderate

D. Severe

E. T2WI

## 3. Discussion

Neonatal jaundice is a common physiological occurrence in newborns. In the hypoxic prenatal period, the child has more red cells, so the fetal hemoglobin is also in high content. After birth, the red blood cell survival time is short. To adapt to the outside hyperoxic environment, the fetal hemoglobin is gradually converted to adult hemoglobin producing a large amount of bilirubin. Jaundice happens when serum bilirubin levels are elevated above 139  $\mu\text{mol/L}$ . The clinical manifestations of neonatal jaundice includes yellow discoloration of the skin and organs, mainly due to elevated serum bilirubin levels. If the concentration of bilirubin in the blood above 342  $\mu\text{mol/L}$ , it breaches the blood brain barrier and acute bilirubin encephalopathy (ABE) or chronic kernicterus occurs with serious damages for the neonates<sup>[4]</sup>. Jaundice can lead to dangerous levels of neonatal hyperbilirubinemia (NHB), causing permanent or nonpermanent neurotic dyskinesia and hearing impairment<sup>[5-6]</sup>. Chronic bilirubin encephalopathy (CBE) or kernicterus mainly affects the subcortical region, such as the

globus pallidus, hypothalamus, substantia nigra, cerebellar dentate nucleus, or hippocampus. However, the underlying mechanisms are still unknown<sup>[7-8]</sup>. Most of ABE neonatal still have a chance to be recovered by timely reducing bilirubin levels, while a few child suffered kernicterus may have some sequelae.

Studies indicated that T1WI increases in the globus pallidus can be useful as diagnostic indicators of ABE. With the development of the disease, it has changed from acute stage to chronic stage. Neonatal with CBE often demonstrate abnormal bilateral, symmetric, high signal intensity on T2WI (or FLAIR) of the globus pallidus and subthalamic nucleus<sup>[9-10]</sup>. In the neonatal period, the basal ganglia nerve cells have strong physiological and biochemical metabolism, so the oxygen consumption is increasing, especially in the middle and posterior parts of the globus pallidus<sup>[11]</sup>. This leads to serum bilirubin deposition selectively in the globus pallidus, especially in middle and posterior position<sup>[12-13]</sup>. Besides, the neurons and glial cells will be damaged with the change of mitochondrial function or apoptosis<sup>[14]</sup>. Basal ganglia pallidus injury caused by

hyperbilirubinemia could be efficiently detected by MRI. The bilateral T1WI pallidal high signal is an important imaging feature of neonatal ABE, while T1WI high signal converted to T2WI high signal is kernicterus's, which suggests neuronal cell necrosis and poor prognosis. At present, the mechanism of MRI signal change still remains unclear, which may be related to the reduction of the T1 value caused by the deposition of bilirubin in glial cells and the destruction of bilirubin to nerve cell membrane<sup>[15]</sup>.

The MRI results mentioned above were obtained from the severe and profound NHB patients who had manifestations of bilirubin encephalopathy or not. So far, it's questionable whether the MRI results of mild and moderate NHB patients are also abnormal. Therefore, the bilirubin level and MRI of 103 patients with jaundice, were retrospectively analyzed to understand whether there were abnormal brain MRI at different bilirubin levels, as well as whether there was a statistical difference in bilirubin levels, gestational age, and birth weight about the abnormal brain MRI results.

According to total serum bilirubin concentration (TSB), the 103 patients in our research were divided into three groups. The mild group was 16 cases (TSB: 0.0 ~ 229.0  $\mu\text{mol/L}$ ), the moderate group was 49 cases (TSB: 229.0 ~ 342.0  $\mu\text{mol/L}$ ), and 38 patients in the severe group (TSB  $\geq$  342.0  $\mu\text{mol/L}$ ). There were 21 patients with abnormal MRI results, including 5 cases in mild group, 8 cases in moderate group, 8 cases in severe group. The difference of bilirubin value between the three groups is significant ( $P < 0.01$ ), whereas, there was no significant difference of abnormalities of brain MRI among the three groups ( $P > 0.05$ ), which indicated that low levels of bilirubin may cause damage to the nerves in patients without BE, and the rate of MRI abnormality is not proportional to the level of bilirubin. This is not consistent with other people's reports that the higher the total bilirubin level, the higher the ratio of abnormal MRI<sup>[16]</sup>. We think that low number of cases in the mild group may also be an important factor. On follow-up at 2 years, Taoka et al. found that the infant is developing normally whether have symmetric T1WI high signal in GP and STN regions or not. According to reports in the literature, it may be related to the development of gray matter ball in GP and STN after birth<sup>[17-18]</sup>. Besides, lots of the literature has reported that this manifestation is one of the brain MRI findings of nuclear jaundice<sup>[19-20]</sup>. Along with the extensive clinical application of MRI, the signs are becoming more and more common in newborn, including healthy baby. Thus, different opinions have yet to emerge recently<sup>[17-18]</sup>. For example, Hris et al. reported that four 5~21 day old neonatals with acute kernicterus had high symmetry signal in the globus pallidus and disappeared during follow-up<sup>[21]</sup>. The author thought that this clinical manifestation had no correlation with the prognosis of the patients. The symptom was temporary, and also appeared in neonatal hypoxic ischemic encephalopathy,

hypoglycemia and other cases<sup>[22]</sup>.

In our research, all patients, with T1WI or T2WI high signal of globus pallidus, has been excluded from neonatal hypoxic ischemic encephalopathy, hypoglycemia, hepatolenticular degeneration and other disease causing the same symptom. Among the 21 patients showing MRI abnormalities, 3 months of follow-up information was available for 9 patients, including 6 patients had normal brain MRI results at reexamination of the 1th month and 3 patients were not reviewed.

Neurological abnormalities occurred in a neonatal at about 2 months showing heterogenous signal intensity of basilar. The maximum bilirubin value of the neonatal is 327.3  $\mu\text{mol/L}$ , with birth weight 3.31kg, gestational age 40 weeks, clear amniotic fluid and the Apgar score 8 at 1 min, 9 in 5min. However, another neonatal, maximum bilirubin value 502.3  $\mu\text{mol/L}$ , birth weight 3.05kg, gestational age 36+3 weeks, clear amniotic fluid and the Apgar score 9 at 1 min, 9 in 5min, did not showing any MRI abnormalities at all. A baby may have ABE, who's brain MRI results suggesting bilateral basal ganglia symmetry T1WI high signal. The maximum bilirubin value of the baby is 130.4  $\mu\text{mol/L}$ , with birth weight 3.5kg, gestational age 40+4 weeks, amniotic fluid in III meconium-stained and the Apgar score 9 at 1 min, 9 in 5min. The high signal of bilateral globus pallidus symmetry is not unique to the neonatal ABE, it also appears in some hypoxic ischemic encephalopathy<sup>[23]</sup>, or even in normal newborns<sup>[24]</sup>. The MRI manifestations of hypoxic ischemic encephalopathy is incompatible with BE, which is characterized by extensive damage of internal capsule, the putamen and the thalamus, accompanied by cortical and subcortical, deep leukoplakia plaque abnormal signals, diffuse brain edema, intracranial hemorrhage and so on<sup>[25]</sup>. Without the history and signs of hypoxic ischemic encephalopathy, the child occurred brain bilateral basal ganglia symmetry T1WI high signal. It may be anoxia that major cause to affect child's permeability of blood brain barrier in antepartum and intrapartum, which lead to free bilirubin increased through the blood-brain barrier, deposited in the basal ganglia, thalamus, subthalamic nucleus, nucleus, ventricular nucleus, caudate nucleus, cerebellum, cerebral cortex, cerebral cortex and spinal cord. The aggregation of bilirubin inhibited the utilization of oxygen by brain, resulting in brain damage<sup>[26]</sup>.

It has reported that the occurrence of neonatal BE is related to gestational age, birth weight, bilirubin binding state, bilirubin level and other factors<sup>[14]</sup>. In the study, 103 patients were divided into pre-term group (26 cases) and full-term group (77 cases). The bilirubin level ( $289.70 \pm 85.38$  vs  $310.36 \pm 72.32$ ,  $P=0.232$ ) and brain MRI abnormal changes ( $P=0.16$ ) did not differ between pre-term and full-term neonates groups ( $P > 0.05$ ), which suggested that there is no difference in bilirubin to central neurotoxicity between pre-term group and full-term group



without BE clinical manifestations. Moreover, it's not that premature neonatal with younger gestational age are more susceptible to bilirubin toxicity. The results may be as follows: (1) While in hospital, pre-term birth patients are treated in time for jaundice. As for full-term patients, when they were sent to the hospital, bilirubin has accumulated a lot in their bodies. On the one hand, high level of bilirubin causes nerve damage through the blood brain barrier easily, on the other hand, the longer the high level bilirubin takes place in the body, the more neurotoxicity of bilirubin is aggravated. (2) Due to lack of pre-term cases, especially the premature patients under 31 weeks, the statistical analysis of data may be biased. while the level of bilirubin in the full-term is high before admission to the hospital. On the one hand, the value of bilirubin is high easily through the blood brain barrier and causes nerve damage. On the other hand, the longer the high bilirubin level is in the body, It also aggravates the neurotoxicity of bilirubin. 2. In this study, the number of cases of preterm delivery was small, and because of obstetric factors, no preterm delivery patients less than 31 weeks, the observation results were also affected. Based on birth weight, 103 patients were divided into <2500g group ( 6 cases of abnormal in 16 cases) and  $\geq 2500$ g group ( 15 cases of abnormal in 87 cases). No significant difference was found in the abnormalities of brain MRI between two groups of newborns birth weight <2500g and  $\geq 2500$ g ( $P=0.09$ ,  $P>0.05$ ). In addition, the difference of bilirubin value between normal groups and abnormal group of MRI is insignificant ( $303.56 \pm 83.04$  vs  $305.55 \pm 74.54$ ,  $P=0.92$ ,  $P < 0.01$ ), which prompted that there is no obvious difference in bilirubin between normal MRI groups

and abnormal MRI group who have jaundice but BE.

In conclusion, in the presence of certain factors, central nervous system damage may occur and abnormalities will appear on MRI, when bilirubin is at low level. Meanwhile, MRI can also provide early imaging signs for neonatal with NHB who have no ABE clinical manifestations, to judge whether there is central nervous system damage on them or not. It also provides clues for early treatment and early intervention, which can avoid the occurrence of severe brain tissue damage and avoid over-treatment for patients who only has hyperbilirubinemia<sup>[27]</sup>.

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# Changes and Clinical Significance of Blood Electrolytes in 203 Children with Febrile Convulsion

*Fen Wang & Yueqin Gu*

(Department of Pediatrics, Taicang First People's Hospital, Taicang 215400, P.R. China)

**Abstract:** The change of blood electrolyte is of great significance in febrile convulsion in children and is likely to be an important inducing factor of febrile convulsion in children, or even be one of the direct reasons. In this study, the average levels of electrolytes such as blood sodium and blood calcium in FC were compared and analyzed to provide reference for further prevention and treatment of FC.

**Key words:** febrile convulsion, blood electrolyte, child electrolyte balance

## Introduction

Febrile convulsion is a common emergency disease in pediatrics. The prevalence rate of childhood is 3 % - 4 %. The initial age is mostly 6 months to 3 years after birth. About 30 % of children with febrile convulsion will relapse [1]. Due to immature organs and unstable system functions in children, it is easy to cause febrile convulsion when respiratory tract infection and other infectious diseases occur. Most febrile seizures occur within 24 hours after fever, while a few occur within 24 - 48 hours. At present, most studies believe that febrile convulsion is self-limiting and has little influence on the growth and development of children. However, the clinical incidence of the disease is high and the recurrence rate is high. If the treatment is not timely, there is a possibility of brain damage, mental retardation and epilepsy [2], therefore, the disease has caused people's attention. The prediction method of FC and the prevention of risk factors for recurrence are hot issues in clinical research at present. In this study, the average levels of electrolytes such as blood sodium and blood calcium in FC were compared and analyzed to provide reference for further prevention and treatment of FC.

## 1. Data and Methods

### 1.1 Febrile convulsion (FC) group

203 children with febrile convulsion treated in our department from January 2017 to June 2017 were selected. The children in the FC group all meet the diagnostic criteria of pediatrics [3] and excluded intracranial infection or other organic and metabolic disorders causing convulsion. Convulsions usually occur after high fever, and the seizure time does not exceed 10 min. Among them, 123 were boys and 80 were girls, aged 0.43 to 5.5 , with an average of ( 2.5 and 0.8 ) years old.

The number of convulsions in 25 children since fever was  $\geq 2$ , and 178 children were 1.

### 1.2 High fever group

100 children with high fever, 46 cases of upper respiratory tract infection and 54 cases of pneumonia diagnosed and treated in our department during the same period were selected. All of them excluded other causes of electrolyte disorder and had no convulsions. Among them, 58 were boys and 42 were girls, aged 0.5 to 6.1 , with an average age of ( 2.4  $\pm$  0.6 ) .

### 1.3 Control group

50 normal children were selected for physical examination in our hospital, among whom there was no statistical significance in age and sex composition.

## 2. Specimen test

All children in FC group took 2ml of venous blood after convulsion was stopped. 2 ml of blood was taken on an empty stomach in the early morning from patients with high fever, no convulsion group and from normal children group. After centrifugation, the blood samples collected were measured with a full automatic biochemical detector to determine the contents of sodium, potassium, calcium, magnesium, chlorine and sugar in children's blood, and the three groups of data were statistically analyzed.

### 2.1 Comparison method

The average values of blood sodium, blood calcium and other electrolyte levels of children in FC group, fever group and control group were compared and analyzed. Children in FC group were divided into  $< 2$  times and  $\geq 2$  times according to the number of convulsions after high fever, and the average values of electrolytes such as sodium and calcium in blood were compared and analyzed.

### 2.2 All results of statistical processing are processed by

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Author: Fen Wang, Taicang First People's Hospital. Yueqin Gu, Taicang First People's Hospital.

**SPSS 13.0 software statistical package**

The counting data are expressed by standard deviation of mean score. The comparison between groups is conducted by  $t$  test,  $p < 0.05$  is statistically significant.

**3. Results**

3.1 Compared with fever group, the blood sodium in FC group was lower than that in fever group, the difference was statistically significant, and there was no statistically significant difference between blood calcium, potassium and blood chlorine

( $p > 0.05$ ). Compared with the control group, the blood sodium of FC group was significantly lower than that of the control group, and there was no statistical difference between the blood calcium, potassium and blood chlorine ( $p > 0.05$ ). Compared with the control group, the blood calcium and blood sodium in the fever group were lower than those in the control group ( $p > 0.05$ ). The difference was not statistically significant, while the difference in blood potassium and blood chlorine was not statistically significant ( $p > 0.05$ ). See table 1.

**Table 1. comparison of electrolyte and blood glucose levels among children in FC group, fever group and control group [ mmol / l,  $\bar{x} \pm s$  ]**

groups	Blood sodium	blood potassium	blood calcium	blood chlorine	blood glucose
FC group	136.39±3.31	4.22±0.52	2.39±0.15	103.06±3.13	7.73±2.04
fever group	142.12±5.51	4.52±0.43	2.48±0.20	103.34±3.85	5.11±0.63
Control group	143.76±4.78	4.54±0.37	2.57±0.19	103.45±4.03	5.20±0.62

3.2 Comparison of electrolyte levels in children with different seizures in FC group shows that the serum sodium and calcium levels in children with seizures  $\geq 2$  times are lower than those in children with convulsions  $< 2$  times ( $p < 0.05$ ),

the difference is statistically significant. There was no statistically significant difference between blood potassium and blood chlorine, as shown in table 2.

**Table 2. Comparison of electrolyte and blood glucose levels in children with different convulsions in FC group [ mmol / l,  $\bar{x} \pm s$  ]**

groups	Blood sodium	blood potassium	blood calcium	blood chlorine	blood glucose
$\geq 2$ times	134.79±1.99	4.15±0.63	2.21±0.19	102.65±2.97	7.66±1.79
$< 2$ times	139.60±1.68	4.26±0.45	2.39±0.15	103.24±2.10	7.88±2.08
P value	$< 0.05$	$> 0.05$	$< 0.05$	$> 0.05$	$> 0.05$

**4. Discussion**

Febrile convulsion in children is the most common acute convulsion in pediatric emergency department. There are many factors that affect FC attack clinically, including immature hypothalamic thermoregulatory center, immature nervous system, immature myelin sheath formation, etc. In addition, they are related to genetics, age, and the cause of acute infection [4].

At present, the pathogenesis of febrile convulsion in children is not clear, and there are reports in the literature. A marked increase in body temperature will lead to excessive excitement in the central nervous system, brain cells are in a state of hypersensitivity, and the activity of electrical signals is obviously increased. High fever also significantly increases the metabolic rate of neurons, oxygen consumption and metabolism, resulting in dysfunction of brain cells, frequent discharge, and finally convulsion [5]. The excitability and conduction of excitement in the nervous system are closely related to the electrolyte level.  $\text{Na}^+$  is the main positive ion in the extracellular fluid and plays an important role in maintaining the osmotic pressure inside and outside the cell and the normal

stress response of nerve-muscle etc. The concentration of  $\text{Na}^+$  is regulated by various organs such as kidney and adrenal cortex.

In this study, it was found that the average blood  $\text{Na}^+$  level of children in FC group was significantly lower than that in fever group and control group, while there was no significant difference between fever group and control group in blood  $\text{Na}^+$  level, indicating that the low  $\text{Na}^+$  level in serum was related to seizures. Clinical studies have found that high fever in the children lasts for a long time, which can lead to hypoxia and ischemia in brain tissue, disorder of brain cell energy metabolism and sodium pump function, thus cause sodium ion influx phenomenon, and eventually lead to hyponatremia and significant reduction of blood sodium content. The body of children with febrile convulsion is in a state of stress. Hypoxic symptoms and convulsions appear simultaneously, the amount of anti-diuretic hormone that hypothalamic pituitary gland secretes has increased significantly, and the amount of water recovered from the collecting tube and the renal distal convoluted tubule increased significantly, thus causing diluted hyponatremia.

Domestic scholars reported that the symptoms of children with recurrent febrile convulsion improved rapidly after

correction of electrolyte imbalance, indicating that hyponatremia caused brain cell edema, changed the threshold of neuronal cell excitation, and even caused convulsion many times. We compared the electrolyte levels of children with different seizures, and found that the blood sodium level of children with more than two convulsions was lower than that of children with only one convulsion. The result was the same as that of domestic and foreign scholars in recent years [6-7]. Hyponatremia caused depolarization of neurons and lowered the threshold of convulsion, which was one of the inducements for children with high fever to have seizures again. In this study, the average blood calcium concentration in FC group was lower than that in fever group and control group, while the difference in blood calcium concentration in children with different seizures in FC group was statistically significant. Because the concentration of  $Ca^{2+}$  maintains the nerve cell membrane, it is of great significance for sodium and potassium ions to pass through the cell membrane, including maintaining the stability of cell membrane selective permeability and regulating the release of synaptic transmitters in neurons. In children with fever, the metabolism increases, the cell decomposition accelerates, causing an increase in blood phosphorus and a decrease in blood calcium. The decrease of  $Ca^{2+}$  concentration leads to the increase of  $Na^{+}$  permeability of axons and sarcolemma of the nerve, and the widespread depolarization of cells, i.e. the increase of nerve-muscle excitability leads to the easy occurrence of convulsion.

It can be seen that the change of blood electrolyte is of great significance in febrile convulsion in children and is likely

to be an important inducing factor of febrile convulsion in children, or even be one of the direct reasons. Therefore, maintaining the electrolyte balance in children is of great significance in preventing convulsion in children.

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# Teaching reform of Engineering Drawing Course Based on Innovation Competition

*Jing Liu*

(School of Mechanical and Power Engineering, East China University of Science and Technology, Shanghai 200237, P.R. China)

**Abstract:** With the proposal of China manufacture 2025, more and more attention has been paid to innovative design. So it is significant to combine innovation competition with engineering graphics teaching. This paper analyzes the promotion of innovation competition to engineering drawing teaching and the content of innovation competition. The content of innovative competition investigation is integrated into engineering drawing course. This can improve students' interest in learning, cultivate students' innovative ability and innovative ideas and promote students' initiative in innovation so as to achieve the goal of cultivating innovative talents. The fusion between the innovation competition and the teaching course also promotes the teaching of engineering drawing and improves the quality of teaching.

**Key words:** innovation competition, engineering drawing, innovation ability, engineering practice

## Introduction

Engineering drawing is a compulsory basic course for engineering majors and it is widely used in machinery manufacturing, architecture, chemical industry, electronics industry, resources and environment, and many other industries. Engineering drawing can cultivate students' ability of space imagination and innovation. The main purpose of this course is to train high-quality engineering talents with good image thinking and design expression ability (ZHANG, 2010). With the proposal of "excellent engineer education and training plan", strong innovation ability is requested for the engineering and technical personnel. The "excellent engineer training program" proposed by the Ministry of education aims to cultivate a large number of high quality engineering technicians to adapt to the development of economy and society (QIN, 2014). At present, innovation ability has become a direction of curriculum training. Some universities in China have discussed the teaching mode of innovative talents and the teaching of engineering drawing (e.g., JIANG, 2014; MAO, 2012; LI, 2017; LIU, 2008). In order to cultivate the students' creative ability better, it is necessary to combine the curriculum content with innovation and entrepreneurship competition. This can cultivate students' innovative and practical ability, and engineering drawing course should be combined with engineering practice.

## 1. The promotion of innovation competition to the

## teaching of engineering drawing

The national 3D digital design competition has been held for the 11th edition. It is a large public welfare event in which the country promotes innovation driven, realizes the transformation from the "manufacturing country" to "creation country", and develops the new era of the digital economy. This is the practice of mass enterprise and innovation. In each competition, there are more than 400 universities, more than 100 enterprises and more than 5000 entries.

Shanghai advanced graphics technology competition has been held for the 8th edition. Every year, all colleges and universities in Shanghai are involved in it. The competition is based on the training and skills of engineers and it aims to popularize advanced design methods. It provides a communication platform for engineers and students in Shanghai's universities and colleges to learn from each other.

By participating in the national 3D digital design competition and advanced graphics technology competition of Shanghai, the students' interest is aroused in learning engineering drawing, the students' creative potential is developed, and the teachers are guided to improve the quality of the curriculum. The combination of the course and the competition offers ideas for the exploration of the curriculum reform.

## 2. Teaching reform based on Innovation Competition

Learn from the advanced concept of the national 3D digital design competition and Shanghai advanced graphics

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**Author:** Jing Liu(1977-), female, doctor, lecturer, mainly engaged in CAD, engineering graphics. E-mail: annaliu200077@163.com

technology competition. In order to reduce the gap between the school teaching and the needs of the enterprise and absorb the teaching experience of New York University, the reform of teaching content based on the innovation competition is carried out in East China University of Science and Technology.

Before the innovation competition, East China University of science and technology held a selection contest to choose some students with good imagination in the whole university. Take a teaching class as the object. Students selected form a team called A. Other students form a team called B. Different teams carry out differential teaching. For the team A, reading, drawing and computer drawing of the mechanical parts and assemblies are strengthened.

Teachers and students of the team A use spare time to train. Through training, teachers can clearly feel the students' progress of the team A in reading ability and drawing ability. Students of team A also feel that their ability has been greatly improved after training. For the team B, the students are proceeding according to the normal teaching progress. In order to test the differences between the two teams in teaching and their influence on subsequent learning, the learning situation of two teams was continuously tracked. Table 1 is the study contrast table for team A and team B. It can be seen clearly from the form that the performance of the team A is better, and the proportion of postgraduate is higher. Through diversified and differentiated teaching, all students are well adapted to this course.

**Table1. Comparison between the team A and the team B**

The object	Average score of engineering drawing	Average score of all course	Percentage of postgraduate students
The team A	88.36	83.16	85.71%
The team B	79.89	72.85	35%

During the course, AutoCAD software is introduced to students. Teachers also encourage students to choose Unigraphics three dimensional modeling software and SolidWorks software to assist engineering drawing learning. Using advanced graphics software to assist engineering drawing will reduce learning difficulty and improve students' interest in learning. In addition, a class group will be set up to answer questions online and answer questions at any time. Through this open discussion, problems can be solved quickly

In the course, award-winning works and other creative

activities are also introduced to the interested students, for example, multifunctional walking stick, multifunctional fitness equipment, shaver design, 3D printing and so on. These can broaden horizons and provide ideas for students.

After the end of the course, students are invited to conduct teaching evaluation on this course. The evaluation is mainly from several aspects of Table 2. Through feedback from students, it can be seen that integrating innovative competitions into courses can give students inspiration to think, associate and innovate.

**Table 2. Students' teaching assessment form**

The proficiency of the course	9.7
Large amount of information	9.8
New ideas, new concepts and new achievements reflecting the development of disciplines	4.9
Concise and accuracy	9.7
Focus and clear ideas	4.9
elicitation method	4.8
Multimedia	9.7
Character specification	4.9
The courseware has great inspiration and good effect	4.8
infectivity	4.8
inspiration of thinking, association and innovation	4.9

Teacher-student interaction	4.7
Strict management	9.6
Good classroom teaching environment	4.9
independent study	4.8
Overall assessment	96.9

### Conclusion

With the proposal of China manufacture 2025, innovation and basic capabilities are two important aspects. For engineering drawing, the innovative ability needs to be integrated into the teaching process of the course. Through the introduction of advanced graphics software in the course and differential teaching, students can be taught in accordance with their aptitude. This can give creative inspiration to different students and cultivate the creative thinking of the students. The cultivation of innovative ability is a complex and long process, which needs to be permeated in every teaching link. It is also necessary to continue to explore and improve the teaching process of engineering drawing.

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# How Chinese Primary School Teachers Teach Mathematics: A Case Study of Beijing Chaoyang Experiment Primary School

*Lihua Chen & Xiaosong Wang & Huijun Xing & Fang Ni & Dacheng Zhao & Tiedao Zhang*

(Chaoyang Experimental Primary School, Beijing 100012 P.R. China)

**Abstract:** The international comparative studies on students' achievements in mathematics discovered that students from China consistently outperform their Western counterparts. This paper is a part of a series of four reports, which trace the origin of mathematics achievement from practice of mathematics education in Chinese primary schools by taking Beijing Chaoyang Experimental Primary School as a case to explore the factors affecting students' mathematics performance. The study reported in this paper investigated how primary school teachers teach mathematics to provide a rich descriptions about Chinese teachers' teaching activities in terms of integrating mathematics teaching and research activities, designing teaching, classroom teaching, and assigning and assessing students' assignments.

**Key words:** Mathematics education, mathematics teaching, Chaoyang Experimental Primary School, integrating teaching and research, case study

## Introduction

Researchers in the field of mathematics education are increasingly becoming aware of the need to look at mathematics teaching in the classroom as the basis for interpreting data on mathematics achievement gap between China and their Western counterparts (Sigler & Hiebert, 1999). This report uses Beijing Chaoyang Experimental Primary School as a case to explore the characteristics of primary school mathematics teaching in China.

In Chaoyang Experimental Primary School, how to teach mathematics efficiently is the core task of every math teacher, and how to promote the student's mathematics learning is the starting point of their teaching. To prepare their teaching, mathematics teachers at Chaoyang are ready to provide answers to the following questions: what are the teaching resources available to teachers; how to use the teaching materials rationally, and how to use the theme maps and exercises in the textbooks; how to creatively reorganize textbooks and effectively implement them in classroom teaching. Under the leadership of Principal Chen, the mathematics teachers team of Chaoyang Experimental Primary School has been forming a mathematics teaching system with the following characteristic: integrating mathematics teaching and research activities, connecting the primary mathematics knowledge points in series, and fully implementing the teaching materials.

## 2. Integrating mathematics teaching and research activities

At Chaoyang Experimental Primary School, mathematics teachers believe that the teaching process is not merely teaching individual knowledge points. What is more important is that knowledge points is linked as a whole. It captures the internal connection between individual mathematics knowledge points and students' knowledge systems. Based on such believes, mathematics teachers have been carrying out the research in their classroom teaching, and integrating teaching with research activities. The following is an example from Ms Chan's mathematics teaching which is about how mathematics teachers should integrate their teaching and research activities.

In the third-grade, there is a teaching content "multiplication of single digits"; in accordance with the arrangement of the teaching materials, one digit should be taught to multiply by two or three digits and each digit is less than 10 in order to solve the sequence problem of multiplication; then teach a certain person with a product of 10 or more, emphasizing students' understanding of the doctrine of accumulating 10 places, and mastering the method of carrying. With 33 pages of content, traditional teaching usually takes 21 lessons. Ms Chen did not follow the steps, but she used her brains for this part of her knowledge. In her view, mathematics knowledge is a tightly structured whole. "A lesson, a unit, or even a book is not an isolated

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**Author:** Chaoyang Experimental Primary School.



island of knowledge. It is a close and coordinated development. Not only that, the primary school stage can also be related to the middle school stage. Because of the overall structure of knowledge and the coordinated development of knowledge and skills, it is necessary to study the status and role of each local knowledge and skills." Based on this reflection, she wrote the key to the unit is to connect point of knowledge, which is the relationship between addition and multiplication:

$$(24+24+24 \text{ —— } 24 \times 3)$$

The growth point of knowledge: "The same number of additions (without steps) plus vertical calculations" and "Multipliers are single-digit multiplications" have a common algorithm.

In the specific instructional design, Ms Chen first arranged an oral calculation exercise ( $24+24+24$ ) and asked the student to speak out the reasoning. In her view, this link can deepen students' understanding of the core concepts such as "digital", "counting unit" and "entry rate", and lay a road for the introduction of new knowledge, and highlighting key points and difficulties. After the students understood the basic arithmetic of addition and multiplication, she began to explain the new teaching content. The first example is:  $24 \times 3$ . This is intended to solve the multiplicative vertical writing method, the operation sequence, and to achieve a preliminary understanding of multiplication skills. The second example titled horse has risen to three digits:  $128 \times 5$ , and it has also added difficulty to carry. From the perspective of the student's narrative process, there are obviously challenges. Because it has lost the support of the addition formula, students must establish new thinking support points. In spite of this, the students' initial skills developed in the first example play a key role in migration: The student clearly uses 3 to take the "4" on one place and 3 to multiply the "2" on the ten place. Now it becomes to use 5 to multiply the number of "1", "2", and "8". As long as they tell them the rules of carrying in time, students can complete this step better.

The third example is:  $2304 \times 8$ . In this step, Ms Chen boldly changed the multiplier from three to four, and at the same time asked the students to try to deal with the "0" in the middle. Based on this, she guided the students to summarize the algorithm. Immediately afterwards, the teacher threw  $2700 \times 3$  again. By changing the position of "0", students' understanding of the concept of "counting unit" was strengthened, so that the newly formed skills were more profound and accurate.

After a lesson, Ms Chan successfully completed the key content of 21 lessons in the textbook. To study its "secrets" is nothing more than grasping the knowledge structure of the teaching materials as a whole and applying the principles of

migration to find the "connection points" and "growth points" of knowledge. In this regard, Ms Chen summarily stated: "I have always believed that there is no isolated teaching. Knowledge should be like a bunch of grapes, and learning can be done afterwards." It is with this "grapes" theory that there are 12 volumes of mathematics in the elementary school stage. The book was condensed into 58 lessons by Ms Chen: The "calculation of the number within a hundred" that originally required 39 hours of class was taught by Ms Chen as a "cockroach". It was only necessary to say "vertical calculation", "carry addition", and "retreat and subtract". "Three lessons are enough; the original "Divisor is a one-digit division," which takes 20 lessons, requires only one lesson. Not only that, in the later experiments, Ms Chen also performed arithmetic operations on four integers (plus, minus, multiply, except for the content, it has been extensively transferred to fractional operations, and even later algebraic operations, and their core and essence have been summed up—the same counting units have been added or subtracted, and the integration of knowledge teaching and skill training has been realized. "If students master this core concept ("add and subtract" from the same count unit), the large number of problems involved in the calculation will be solved.

Throughout the entire primary school period, including the addition, subtraction, and subtraction of decimal numbers, fractions, and decimals, a total of 109 lessons can be resolved in 3 lessons if they are attributed to the addition and subtraction of the same unit. In this process, mathematics teachers not only can help students to establish the link between different knowledges, but more importantly, they can develop students' ability to migrate and think mathematically. Therefore, as teachers, they must firmly grasp the migration of thinking and let students learn one problem, and in fact master one type of problem. It has been seen that as long as the teachers understand the teaching materials, they can effectively conduct effective classroom teaching.

### 3. Designing teaching

On the basis of full understanding of teaching materials, mathematics teachers at Chaoyang carry out teaching design for each lesson. As a math teacher, suitable and effective design is the basis for improving the efficiency and quality of classroom teaching. "Teaching design" is a teacher's thinking process recorded in a written language during the lesson preparation process. It is a plan for teachers to organize classroom teaching activities. The following is a brief description of the fifth grade teaching entitled "observing objects", which includes five different analysis:

(1) This part of the "observation of objects" is mainly for the development of students' concept of space.

"Mathematics Curriculum Standards" points out that "the concept of space is reflected in the fact that geometric shapes can be imagined by physical objects, shapes of objects can be imagined by geometry, and transformations between geometry and its three-view and unfolded figures can be made." "The understanding of concept of space is the ability to grasp the interrelationship between three-dimensional space and two-dimensional space?" This lesson creates rich activities around the transformation between geometry and its three views, allowing students to fully experience and feel in the activities, and firmly grasps the connection between three-dimensional space and two-dimensional space in the process of discussion to promote students' concept of space.

(2) The teaching background analysis includes the study content analysis, student situation analysis, teaching methods and instructions, teaching preparation, technical preparation, and previous teaching status, problems, and countermeasures.

(3) Textbook analysis refers to the analysis of the basic content of teaching, as well as the logical relationship between the points. To clarify the arrangement intention or arrangement characteristics of the content of this section of the teaching materials, to clarify the attachments (such as illustrations, atlases, notes, practice questions, thinking questions, reading materials, etc.) and their functions that are closely related to the contents of the teaching materials. The link between the teaching content of this lesson and the existing knowledge and follow-up knowledge. To clarify the role and status of the contents of this section of the teaching material in the whole set of teaching materials or the whole unit, to explain its importance and particularity, and to explain its inspiration and follow-up to the previous and the next textbooks. That is to say, before and after the combing, the contents of the teaching are closely related, and the contents of the teaching are closely related.

(4) "Observing objects" is a newly added content after the curriculum reform. It belongs to the "Graphic Cognition" section of the "Space and Graphics" field. The teaching materials of the People's Education Press are arranged in two stages at the elementary school stage. The first stage is on the second grade. The main observation is the physical objects that are familiar to each other and require to recognize from different angles (front, side, above). The second stage is the first volume in the fifth grade. The main observations are geometric shapes, requiring the ability to recognize the shape and relative position of two objects or a set of three-dimensional figures seen from different orientations. The study of the "observation of objects" has accumulated some experience for understanding the three-dimensional figures, and at the same time laid the groundwork for the third segment to learn about "views and projections." The teaching materials of Jiangsu Education Publishing House

and Beijing Normal University also made up the content of "observation of objects", which is also the transition from observing objects to observing geometric shapes. Its module mainly contains three examples. This lesson deals with Examples 1 and 2. In the textbook, first of all, by observing the small medicine box (with different patterns on top and in front of it), you can see the rectangular shape seen from different angles. The number of faces may vary, up to three faces can be seen at the same time. Then the pictures of the small medicine boxes seen from different angles (front, left, and above) are presented to judge from which direction they are respectively seen. After observing the small pillbox, the textbook presents two geometric shapes (a ball and a cylinder) and pictures of the two geometric shapes from different angles (front, left, and top), and then recognizes that they are seen from different positions. The shape and relative position of two objects. In the one-to-one session, a set of graphs based on observing two objects from the front is also designed to determine the activities that may result from observing which two objects are combined.

(5) Academic analysis refers to analyzing the related pre-conceptual level before the students study the content of the lesson and explaining the problems, difficulties and countermeasures that may be encountered in the learning process. Because the situation of students in each class will be different, the design suitable for students is a good design. Therefore, in the design of teaching, we must consider: The existing knowledge and experience basis that students need to learn new knowledge are not solid? What are the learning difficulties for students who want to learn new knowledge? What are the questions that students are interested in? These questions can be obtained through questionnaires, interviews, collections, and collation of academic information reflected in student assignments (or test papers), as well as materials such as reviews and reflections on past teaching. Teachers must have their own analysis of these materials and have their own thinking.

#### 4. Teaching process and teaching resources design

This section is the core of instructional design. It should be clear about teaching content, teaching process, student activities, required teaching resources and teaching instruction strategies. It can be attached to the teaching flow chart; it should clearly describe the teaching objectives and teaching process, and elaborates The logical relationship between the teaching sessions analyzes the importance of the timing and use points of resources in highlighting teaching priorities and teaching difficulties. It also analyzes and explains the teaching strategies that focus on the formation of student concepts, describes the trajectory of students' thinking development, and analyzes the teaching process.

Possible generations in the description of the coping strategies. This part is explained in detail in the following classroom teaching.

Classroom teaching is a commonly used method in teachers' teaching. It is the entire process of teachers imparting knowledge and skills. It is mainly through the exchange of teachers and students, the interaction between students and other methods to master mathematics knowledge, and obtain the process of mathematics experience. It is the implementation of teaching.

In teaching design, it is necessary to fully presuppose possible situations in the classroom, but in the process of classroom teaching, teachers are still required to make effective adjustments in time according to the situation generated in the classroom. This is a sign of teacher's maturity level. Teachers must organize student learning in the teaching process, including: organizing student seminars, organizing students' operating practices, organizing student exchanges, and organizing student evaluations. In organizing exchanges, they can exchange feelings, ideas, exchange learning methods, exchange the results of inquiry, and exchange difficulties in learning. There are several principles to be observed when organizing student activities: 1 Students can do it, teachers do not; students can speak, and teachers do not. 2 It can never be done one to one by being able to participate. 3 The way of operation enables students to say what they want to say and do what they want to do. Of course, teacher's guidance is also indispensable during the teaching process. Attention should be paid to the content and timing when guiding. In particular, when guiding students to think deeply, when learning methods need to be taught, when the key points of knowledge are grasped, breakthroughs will be made based on students' difficulties.

For example, in the teaching of Observing Objects, in the previous analysis, classroom teaching was conducted through five activities.

Activity 1: Use the story of "blind people to touch the elephant" to experience a full understanding of things.

(1) Produce: "blind people touched" story pictures (2) The teacher tells the story of the blind man (3) Division: What do you think about this story? Surveillance: 1 Why do the elephants described by each blind person are different? 2 Have you seen this kind of situation? Can you give an example? 3 Observe things to be comprehensive and not be partial. (4) Teacher: We all have this experience in life. Although we are observing the same object, the shapes of the objects that can be seen in different positions are different. In this lesson we will continue to study the content of observing objects and see if the students can achieve new results.

Activity 2: In the process of observing the "small medicine chest", feel the shape of an object observed from

the front, side, and top.

1. Studying the results of observing cuboids from different angles clearly shows that at most three faces can be seen at the same time. (1) Produce "Small Medicine Box" (2) Teacher: The teacher prepared a rectangular medicine box for each group of students. Ask the students to observe the rectangular medicine box. Would you please say that the medicine box has several faces? What are the faces? (3) Teacher: Ask the students to use the group as a unit to select an angle to observe the medicine box and talk about which side you can see. And use the camera to record different situations. (4) Group discussion (5) Reporting and exchange

Surveillance: 1 Can you see a few faces? 2 From which perspective do you see it? (The method of attention observation) 3 can see a few faces? Summary: We can't see all the faces of an object at any position, and we can only see at most 3 faces of the cuboid.

[Design intent: Students on the basis of self-observation, in the process of teacher-student communication, and student-to-student communication, truly clarify the observation of objects from different perspectives, and the shapes they see are different. With the help of the camera's features, students' communication is facilitated. Enable students to realize that all faces of the object cannot be seen at any position at the same time, and only three faces can be seen at most. As a result, students have accumulated experience in observing plane geometry, cultivated observation and imagination capabilities, and initially established spatial concepts.]

2. Feel the shape of an object as viewed from the front, side, and top.(1) Show



(2) Teacher

The figures on the right are the little girls seen from the front, left, and above. Ask the students to independently judge the three pictures, which are the little girls who see from the side of the kit.

(3) reporting and exchange

Surveillance: 1 How did you determine if this side was seen from the left? 2 How did you determine this aspect from above? 3 If there is no "word" and "cross mark" how to judge it? Summary: As a result, we once again discovered that the same object may be seen from different locations and the shape may be different.

[Design intent: With the help of "How do you determine this aspect is seen from above?" This seminar will guide students in the process of communicating and summarizing judgments and develop students' reasoning abilities. With "How to judge if there is no "word" and "cross mark"?" It

prompts students to get rid of the level judged only by the patterns on each side, triggering students' deep thinking, shifting the focus to the shape of each side...]

Activity 3: In the course of observing the "ball and cylinder", feel the positional relationship and shape of the two objects observed from the front, side, and top.

1. Observe the sphere and the cylinder separately and discuss the shape from the front. (1) Present: Ball plaster model (2) Teacher: Ask the students to observe the sphere from different angles. What shape did you see? What did you find? Presupposition: The view given to us from the sphere is circular regardless of the position. (3) Present: Cylindrical plaster model (4) Teacher: Let's look at the cylinder again. Ask the students to try it out from different angles and see what shape you see from different angles. Observe that the line of sight must be perpendicular to the surface of the object being viewed, regardless of the position from which it was observed. (The teacher shows it to the students.) If your idea is not quite certain, you can also take a picture with your camera and observe it. After everyone has ideas, talk to the students in the group. (5) Students observe independently and discuss in groups. (6) Report exchange: Preset: 1 See the top of the cylinder, it is round 2 When you look at the side, you see a graph with radians 3 saw the side of the cylinder and found it to be a rectangle Monitoring: 1 From which perspective do you observe? Is the line of sight perpendicular to the surface of the cylinder? 2 What shape do you see? 3 Do you agree with his idea? 4 How far away is it to look at it with a camera? (7) Courseware demonstration: The cylinder is pushed from near to far (8) Teacher: Ask the students to observe carefully and see what is found? Preset: The farther away you look, the more like a rectangle (9) Question: If the cylinder becomes shorter (height=bottom diameter), what shape do you see on the side of it? Summary: Through previous research we have found that when we look at the cylinder from the front, we may see rectangles or squares.

[Design intent: to observe the sphere and the cylinder alone, reducing the difficulty of this lesson. During the team's collaborative exploration process, students found that when viewing the three-dimensional shape of the curved surface, they did not resemble a plane geometry, causing cognitive conflicts. Through the demonstration of the courseware, the teacher promptly asked the students to observe from near and far, so that they really establish the concept of space, and build a bridge of thinking for the next observation of the combined form.]

2. Feel the positional relationship and shape of two objects viewed from the front, side, and top. (1) Produce:



(2) Question:

These figures are from which direction did the little girl see? Surveillance: 1 How did you determine if this map was seen from the front? 2 How did you determine if this map was seen from above? 3 How did you determine if this map was seen from the left? (3) Question: If you look at these two objects from the right, what shape do you see? What is the difference with the observation from the left? Why are the results seen on the left and right sides different?

Summary: It seems that if we are observing two objects, we must clarify their positional relationship in the judgment process. We can identify the shapes seen from different locations based on their positional relationship.

[Design intent: On the basis of observing a single object, allow students to observe the combination of two single objects to further cultivate students' observation ability and develop their spatial concept.]

Activity 4: With the help of "guessing objects" and "blocking holes" activities, students' judgment and reasoning abilities are developed and students' spatial concepts are developed.

1. Guess the object.

(1) Produce:



(2) Division: The following picture is viewed from the front of two objects. Ask the students to use the group as a unit. Think of what the two objects are like.

(3) Panel discussion

(4) Reporting and exchange

Surveillance: 1 What do you think these two objects are like?

2 How did you judge it?

Is 3 necessarily the object?

4 What may be the object?

(5) It seems that we cannot be sure exactly what these two objects are. Can you think of a good way to let everyone know what this is?

(6) Division: I have views from the left, right, and above. If you can only select one of them, which one do you want to choose?

Monitor: 1 Why did you choose this picture? 2 If you can choose other plans can not? 3 What are these two objects?

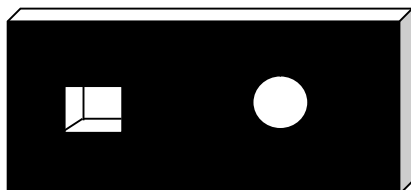
Summary: We observed through observation that we can not determine the shape of the object based on the shape of only one direction. We can only make an accurate judgment by synthesizing the shapes seen from different directions.

[Design intent: In the process of guessing objects, students really experienced the process of imagination, guessing, analysis, and reasoning, which promoted the

students' concept of space to be further developed and their reasoning ability improved.]

2. Select objects and keep things closed.

(1) Produce:

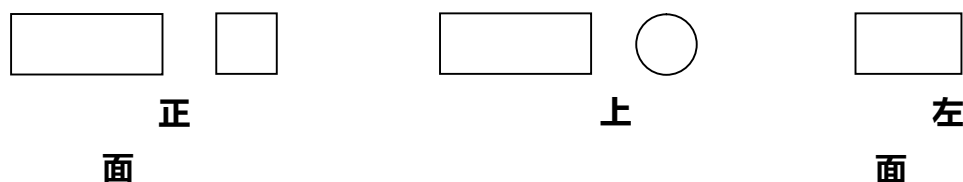


(2) Division: There are two holes in this box, one is a circular hole and the other is a square hole. There are four kinds of three-dimensional graphics below. Would you like to think about which kind of three-dimensional graphics can just plug these two holes? Surveillance: 1 What do you think? 2 Can I use other solid graphics? 3 Can you block the two holes with a three-dimensional figure? (3) Division: What do you think of through this activity? What is the connection between the problem of selecting a three-dimensional figure and what we are studying today?

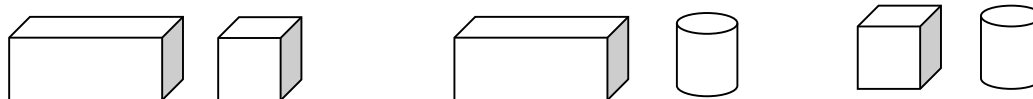
[Design intent: In the process of selecting the three-dimensional graphics to plug holes, the method of observing the objects is used to solve the problems, inspire students' interest in learning, and develop students' geometrical intuition]

E. Talk about the harvest and summarize the lesson. Teacher: What have you learned from this lesson? Teachers through the design of five activities, through the question

(2) As shown in the figure, below is a picture of Xiao Ming who viewed two objects from the front, top, and left sides respectively:



The two objects are ( ).



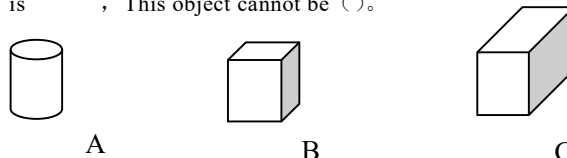
For the pre-departmental survey, students have more difficulty in observing the cylinder. Through the first question, they understand the students' knowledge of this issue after class. The second question is mainly to understand whether students can judge the positional relationship and shape of two objects observed from the front, side, and top. Although there are few questions, it can reflect whether the goals of this lesson are achieved.

For important teaching content, it may take several hours to complete, and gradients must be reflected in the design of the assignment. The following is a brief description

triggered students thinking, through the study of these issues, so that students really experience the process of imagination, guessing, analysis and reasoning, so that students gradually clear that can not be seen only in one direction Determine what the three-dimensional shape of this object is, and only when the shapes seen from different directions are synthesized, can an accurate judgment be made. At the same time, the students' concept of space has been further developed and their reasoning ability has been improved. Teachers are organizers and guides in the classroom and give the students the center of the class. They only need to be called at the right time.

### 5. Arrangement and Evaluation of Operation

After the class under normal circumstances, teachers will arrange some written assignments in order to understand and give feedback on the content of teaching content. The assignment must be targeted, and teachers should also think about how to design the topic so that they can achieve their own goals. Or take the content of Observing Objects as an example:(1) An object, the graphic seen from the left is , This object cannot be ( ).

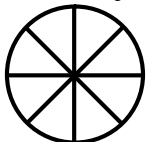


of the area of a circle. (1) A circle with a radius of 4 cm. Its area is ( ) square centimeters. (2) A 4 cm diameter circle whose area is ( ) square centimeters. These two topics are basic questions and are mainly used to understand whether students have mastered the area calculation method for the circle. Such a problem is the basis, but when students master it, they do not need a lot of practice.

(3) Divide a circle into 12 equal parts to form an approximate trapezoid. The lower base of this trapezoid is known to be 3.14 cm. The height of this trapezoid is ( )cm.

This topic is to examine whether the students'

understanding of the circle's derivation process is understood and whether students understand it after class operation. This kind of problem is somewhat difficult for students and needs proper attention. (4) When studying "Circular Area", the students discussed together "Why is the area formula of the circle?". Obviously said: "You can divide the circle into 8 equal parts and put together an approximate trapezoid, and then you can derive the formula for the area of the circle." Do you agree with the idea? Please explain your reason.



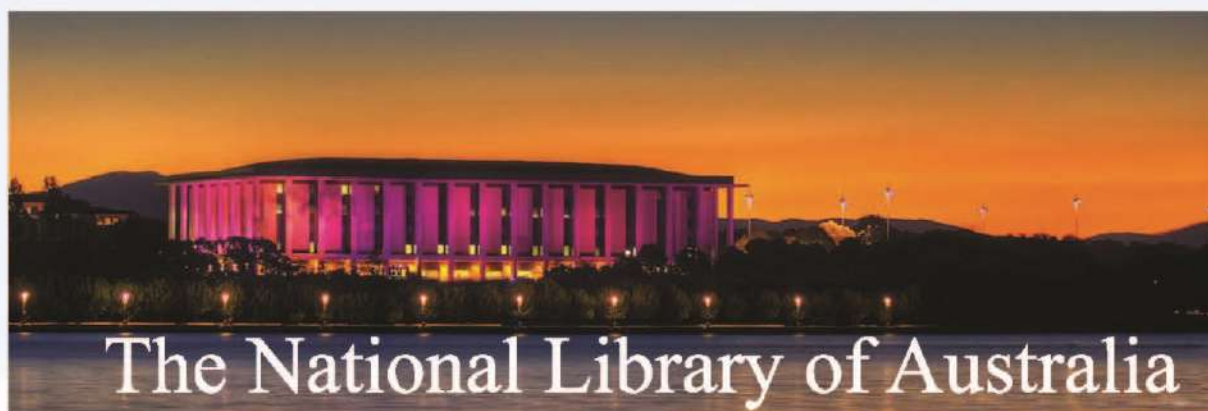
This topic adopts an open method to examine whether students have mastered the process of derivation of the area of the circle and whether it can explain the reasoning process. Such topics are difficult for primary school students and require teachers to guide students according to circumstances. In addition to considering specificity in layout operations, the amount of work should also be controlled. The number of placements should not be excessive, and the number of feedbacks can be appropriately increased as needed. The forms of homework can also be varied. In addition to routine layout exercises, mathematics practice activities, mathematical research, mathematics tabloids, and mathematics diaries can be arranged. Pupils are relatively young, they must be accurate and meticulous in the marking of assignments, and can be annotated as needed, and

face-to-face corrections can be used to improve the efficiency of learning.

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