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# GANSU STUDIO: 'PLUG IN' SCHOOL UNIT FOR RURAL CHINA

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## ESTUDIO EN GANSÚ: UNIDAD ESCOLAR “PLUG IN” EN LA CHINA RURAL

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**ABSTRACT:** Gansú 'Plug-in' Studio was a community outreach project based in China developed over a course of 2 years (2014-2016). It proposed a complementary approach of education to improve quality of learning in primary schools in rural areas. The premise for the work was to engage higher education institutions such as UNNC and primary education institutions, such as HEPAN, by exchange of resources, (e.g. physical or human - staff and students as well as contexts as real opportunities for learning). It worked using design as a tool for development and environmental awareness. It worked in partnership with industry and government institutions and it involved over 120 students and 15 staff from 5 different areas (Architecture, Product Design, Environmental Engineering, Film Studies and English/Education). Through interactive workshops with academics and industry practitioners, UNNC students were guided to realise their ideas through innovative design and sustainable engineering solutions, also developed their communication and team working skills for real to help rural education and community development.

Meanwhile, pupils and teachers in rural areas could develop sufficiently as their urban counterparts through this connected learning hub. The purpose of this paper is to discuss the processes and outcomes of Gansu Studio. The Plug-in Gansu Unit was designed to be the first net positive energy rural school building in China producing an estimated 18304 kWh/year of renewable energy to the school and reverting back to the county grid an annual extra clean energy 2304kWh/annum upon completion. An estimated 22 tons of water per year would be also saved.

Keywords: design for development; rural education; environmental awareness; Chinese context; creativity and innovation in education.

RESUMEN: El estudio "Plug In" en Gansú fue un proyecto de extensión comunitaria basado en China, desarrollado en el curso de dos años (2014-2016). El estudio propuso un abordaje complementario a la educación para mejorar la calidad de aprendizaje en las escuelas en áreas rurales. La premisa para el trabajo era involucrarse en instituciones de educación superior como la UNNC y en instituciones de educación primaria, como Hegan, por medio del intercambio de recursos (por ejemplo, recursos físicos o humanos por parte de miembros del equipo y estudiantes, así como contextos como oportunidades reales para el aprendizaje). Ello funcionó usando el diseño como una herramienta para el desarrollo y la conciencia ambiental. También funcionó en sociedad con instituciones industriales y gubernamentales, e involucró a más de 120 estudiantes y 15 miembros del equipo de cinco áreas diferentes (arquitectura, diseño de producto, ingeniería ambiental, estudios fílmicos e inglés/educación). A través de talleres interactivos con académicos y practicantes de la industria, estudiantes de la UNNC fueron guiados para llevar a la práctica sus ideas a través de diseños innovativos y soluciones de ingeniería sustentables. También desarrollaron realmente sus habilidades de comunicación y trabajo en equipo para ayudar al desarrollo de la comunidad y la educación rural. Mientras tanto, los pupilos y los maestros en áreas rurales pudieron desarrollarse lo suficiente como sus contrapartes urbanas a través de este eje conectado de aprendizaje. El propósito de este trabajo es discutir los procesos y resultados del estudio en Gansú. La unidad Plug In de Gansú fue diseñada para ser el primer edificio escolar rural con energía positiva neta, produciendo un estimado de 18304 kWh/año de energía renovable para la escuela, devolviendo al entramado del condado 2304 kWh/año de energía limpia luego de su concreción. También es ahorrado un estimado de 22 toneladas de agua por año.

Palabras clave: diseño para el desarrollo; educación rural; conciencia ambiental; contexto chino; creatividad e innovación en educación.

## I. Introduction

Brazil, China, India, Russia and South Africa are the well-known 5 emerging economies commonly associated with the acronym BRICS (MFA 2017). Their influence can be quickly demonstrated by their combined figure of over 20% of the Gross World Product. Their joint population of 3 billion people represents over 40% of the world's population. Half of that (around 1,518 billion people) are living in rural areas, despite the world's rapid urbanization pace (Alves, 2015).

China has been well-known for its priority policies on urban development intensively pushing towards a fast-paced urbanization while making rural development a secondary goal. The inequality gap between Eastern and Western provinces, rural and urban is a by-product of such selective model of development (Hornby, 2013). The result has been one of the largest migrations in history happening from rural to urban, from West to East in China. In a sense, this is what has been sustaining such impressive GDP growth and economic advancements over the last decades (Bove & Elia, 2017). The exodus happen as cities can offer living conditions that are more prosperous, with potential for labour mobility, job opportunities, some access to health care and quality education despite the Hukou restrictions on migrants.

Rural areas in China are today places for those left behind, the elderly and the very young, and are perceived as undesirable and backwards by many locals, especially the young and their urban counterparts. No doubt, as the annual per capita income for a rural household in Gansu is 6,277 Rmb, while in the same province an urban annual per capita income is 21,804 Rmb. If we compare these figures with the Eastern provinces, the gap can be even wider. A rural household in the province of Zhejiang, where the authors live, is 19,373Rmb and an annual urban per capita income for the same province will be 40,393Rmb (Shapiro, 2016). This current divide denies rural Chinese citizens (over 600 million today in China) from the choice to remain rural, prosperous, proud of their local context and to enjoy the benefits of being 1st class citizens as their urban counterparts. Poverty does not need to be associated with rural livelihoods, and rural citizens should not be told to either continue exiting to cities or 'tighten their belts' for one more generation till China decides it's time to take rural development seriously.

## II. Rural Education in China

The Chinese Government has made rapid strides on improving schooling infrastructure and providing access to education through its compulsory

nine-year universal programme. However, there is still a long way towards the way delivery of education is strengthened and a considerable gap between urban and rural schools in China is diminished. As Andreas Schleicher, the OECD special advisor on education policy described, “For years, China spent only around 2% of gross domestic product on education, compared with the minimum 6% recommended by the United Nations” (Floracruz, 2013). And still only 5% of rural students in China attend college and 60% of students drop out before high school (Project Partner, 2017). It is through improving quality of education equally for rural and urban citizens that a shift onto new activities and labour mobility in rural regions can happen (by provision of appropriate training, incentives and investment from the early primary school years).

Teaching delivery has been identified as the key aspect to improving quality of education in rural areas (Yan *et al.*, 2013). Generally, rural teachers have not had opportunities for appropriate training, but still must teach a much higher number of students and a range of subjects outside their scope of knowledge. The focus in rural areas still is on achieving high marks for Chinese, Maths and English as a way towards acceptance into universities, and an exit towards Eastern provinces, which are more prosperous. Such educational practices have a direct impact on the observed lower graduation rates and lower achievement on compulsory subjects such as English, Chinese or Math in rural areas (Liu *et al.*, 2016). Students from Rural Western provinces like Gansu, where this project is located, are falling well below the national curriculum standards levels and the divide between East and West and between rural and urban China is only becoming wider (Yi *et al.*, 2012).

As the entire school system, including teacher pay and promotion, is geared towards the compulsory subject’s outcome, most other subjects are neglected and some, like music, movement and the arts, completely set aside. Subjects that explore the contextual understanding with an environmental focus towards the sciences and cultural learning are also not necessarily predominant (Liu *et al.*, 2016).

Investing on creative arts and technologies curriculum, Art-Sciences, it is a well know pathway to increase cognitive abilities of children that tend to fall well behind national assessment standards (Robinson & Arnica, 2016). This can enhance their chances of reaching better state educational providers at higher levels, better vocational or university training and therefore employment. It is agreed (Garner, 2014) that to promote a shift from memorizing (rote learning) to understanding, application and integration of knowledge requires a learning environment that stimulates and promotes creativity and that includes local context, problems and solutions at its core.

School-leavers in rural areas such as Gansu, have little exposure to innovative and creative thinking, and to a deeper environmental understanding of their contexts, and therefore have little idea on how to reinvent and recreate their own realities. As they progress with little or no connection, low appreciation for their own local culture and environment young people are driven away in search of idealized urban conditions despite the challenges posed by the Chinese 'Hukou' system (Liu, 2005), which prioritizes local urban citizens for benefits and rights and excludes or makes rural residents foreigners in their own country.

This unbalanced growth has a negative impact on the country, as it tends to intensify the gap between East and West, rural and urban areas. The more the educational system can emphasize the power of innovation, creativity and value for the environment, the bigger and more valuable will be the contributions that China will be able to provide in the 21st Century as a global leader.

### III. Setting the scene: Design Brief & Targets

"Project Gansu" refers to the 'plug-in prototype design' for a New A-Dream1 classroom and volunteer accommodation for Hegan Primary School, Hegan Town, Huining County, Baying Prefecture, Gansu Province. The project was developed from 2014-2016 at different stages.

This design brief was developed to promote the work on teaching delivery already established by our partner charity organization. A-dream Shanghai courses have been held in existing school classrooms (urban or rural) up till recently, but they were interested in expanding their programme to remote schools which do not have facilities and/or to improve the mobility of volunteers, the training of rural teachers into remote areas by building their own units, with self-sufficient volunteer accommodation on-site. This approach would certainly bring a more effective presence into the community by a better engagement of A-Dream staff and volunteers, resulting on a more contextualized A-Dream curriculum and enhanced educational quality. This would allow UNNC students and staff to engage with the community, from design to delivery, and beyond.

In this sense, the brief was established to design and fundraise for construction a fully equipped prototype classroom for Hegan Primary School, to be operated by A-Dream and UNNC. The design would need to be easily adapted for different building sites in different parts of China where A-Dream already had a presence across China (over 2,000 schools). It was

also intended to be a demonstration project for sustainable construction, showcasing passive design and alternative sustainable technologies (e.g. waste, water, energy, agricultural production) relevant to the site and to have such technologies displayed for enhanced curriculum development at the host primary school grounds.

The results of this work aimed to make education a more holistic enterprise, by combining several fields: engineering, architectural design, product design, interior design, IT and education. The 100 m<sup>2</sup> Plug-in School Unit was to be linked at first remotely to UNNC campus and other selected primary schools in the region, for exchange of information and learning, and to expand on the vision of a global, accessible and affordable quality education for all.

The unit was to act as a support system for the school in which physically it is inserted. But it is also a decentralized concept, physically independent school that can be remotely activated, unique, self-sufficient and connected. Sharing information and knowledge on a local and physical level, but also being part within a network of other schools and possible 'plug-in school units' available in regions across China, where sharing of information (primary, secondary and university students and staff) could be made possible. The aim of the project was to provide proven methods and results (via the design and promotion of a Plug-in Design Unit) that can clearly enhance development for isolated communities, by focusing on design for development, creativity & innovation and environmental engineering for an education that fosters self- sufficiency and connectivity.

#### **IV.1. Initial Phase of Development for the 'Plug-In' School Unit**

Project Gansu was initiated as a student centered design competition for ideas about how education, design and development could be linked to improve quality of rural education in China. This foundational work has helped us to map the issues of how spatial design can respond to the delivery of a holistic education within a rural environment. On this process UNNC partnered with A-Dream and this collaboration was initiated with a site/community survey in January 2015, where Hegan Primary School became the chosen school for our design- build prototype project. Over 120 students took part on this competition from across the UNNC departments and faculties.

The location chosen for this project was Hegan County, located at Gansu Province. Gansu has always been an important outpost for the Chinese

during Imperial times and has been a cultural transmission path for the Silk Road economy and culture. During the Republican era, Gansu has been on decline due to famines, droughts and earthquakes. Nowadays, it is still one of the poorest provinces in China with an economy based mainly on mining and petrochemicals. Lanzhou is the capital of Gansu and it's a well-developed city with a population of over 3.5 million people. It has been ranked in the past as the worst air quality in the planet, due to its industrial pollution. Hegan, a county of over 20,000 inhabitants is a four-hour drive from Lanzhou and is the context for our project. It is a remote agricultural village in the dry Loess plateau of Gansu Province. It has a very low rainfall, hot summers and very cold winters (temperature range from  $-20$  in winter to  $+30$  in summer). Traditional housing in Hegan is built in sun-dried adobe brick from the clay-rich local soil. Children from all over the county come to be schooled at Hegan Primary, living in the dormitory or with relatives in Hegan village. Hegan Primary School has 1,700 students and 76 teachers. Our Plug-in Unit school has been designed for the specific plot of land on Figure 3, at Hegan Primary School.

Figures 1, 2. (Left) Typical house at Hegan Village (Right) Houses on the vicinities of Hegan Village.



Figures 3, 4. (Left): Site of Plug-In School Unit. (Right) Dormitory at upper levels and Kitchen at lower level at Hegan Primary School.



Figures 5, 6, 7 (Site visits at Hegan county January 2015 for Design Competition UNNC)



Figures 8, 9, 10 (Left) Staff and students at Design Competition reviews (Middle) Engineering, Product Design and Architecture students at reviews (Right) Architect in Residence 2014-15 Adrian Welke with Architecture students in Studio



Figures 11,12 (Final submission panels for DTCC – Merit Award 2nd Place)



After engaging industry partners from China and abroad, 5 finalist teams received merit awards after the end of the competition. The outcomes and project brief received much interest from management at UNNC and Project Gansu Studio: 'Plug-in Unit' as delivered was born.

External industry partners were also involved at this stage, and the project was nominated in September 2015, as the first LifeCycle 5 China campaign, by UNNC management. Gansu Design for real project took form as a compulsory part of the Architecture Curriculum, as the first DESIGN for REAL project of its kind at UNNC. The programme engaged 26 3rd year architecture students and 25 Nottingham Advantage Award (NAA) students. This subject was an elective created to support interdisciplinary research and fieldwork conducted at Hegan. Students from 5 different disciplines (Architecture,

Product Design, Film studies, English and Education, Environmental Engineering) took part on this course. Self-formed students' design teams explored their own way of contributing and managing their teams, which were well expected from graduates and highly praised by industry advisory panel. A fundraising campaign was launched by UNNC management team as part of the LifeCycle 5 campaign, to design and build the first positive energy rural school building in China by the end of summer 2016.

#### IV.2. Phase 2: Studio Gansu and Community Consultation

Almost 50 students in total have jointly worked from September 2015 till January 2016 on the development of a restructured proposal for Gansu Plug-in after the design competition. Project Gansu started with a site visit in September 2015 and by the end of the semester (3 site visits in total were conducted). Several students and staff were able to visit the site and conduct interviews, site assessment and community consultation.

While the architecture students developed the landscape and architectural proposals for a 100m<sup>2</sup> school unit, the product design students developed interior and exterior product design projects. The environmental engineering students developed from water recycling, solar energy roofing and energy efficiency building design projects to automated intelligent systems for the unit. Film studies students worked on questionnaires and interviews with teachers and the perception of development and environmental awareness for a documentary. Education and English students analysed the current A-Dream curriculum and its local adaptation and appropriate resources when connected to the unit to be designed in Heban. They have all played an active role on questioning, supporting and advising on directions for improving learning and teaching.

Figures 13, 14, 15 (Left)- Architecture student and local resident during interviews in Heban. (Middle) Principal of Heban Primary School and English Major student during site visit in October 2015. (Right) Students and staff with 3rd and 4th graders at Heban Primary school after PE session.



Figures 16, 17, 18. Architecture and Product Design Students during cross-disciplinary sessions at UNNC.



NAA units have worked as the consulting and bridging platform for the project, between internal tutors and external community and consulting team. Mostly senior students, the NAA worked all the way from September 2015 till the end of the project, in June 2016, when only the external consulting architects and engineers engaged on the final steps of detailing and technical delivery. The students involved have been actively engaged with practitioners, as part of a mentoring system created specifically in conjunction with the NAA Design for Real Gansu. CIBSE mentoring system has been working with our NAA and other engineering volunteer students with special placements for our students at their workplaces in Shanghai.

Figures 19, 20, 21 (Left) During site visit at Hegan Primary School. UNNC students and children doing drawing exercises. (Middle) Staff and students from engineering, demonstrating automated systems design for Plug-In Unit at Open day at UNNC. (Right) Detailing phase for Architecture students in Studio.



Figures 22,23. Children from Hegan Primary at Consultation phase (left) inspecting models and (right) drawing with UNNC students during brief design phase (drawing session).



A web platform was set up to gain public interest towards the fundraising campaign for LifeCycle5. Early December 2015, during reviews, 8 project proposals were presented by the Architecture students and went for public voting on WeChat (Chinese Facebook platform). Throughout the studio, several public reviews were conducted. Experts from different areas, and from a few different countries were invited to attend reviews and give talks (online) or at UNNC campus.

Figures 24,25,26 Public voting format on WeChat., set up by students, which attracted over 20,000 visitors online. BELONGING (Left), RIVER VALLEY (Middle) and MARKET (Right) were later also preselected for the community consultation.



The design process at Gansu Studio started with 26 students submitting individual concept designs in early October. 14 themes were identified, and students were grouped to design preliminary proposals, which were reviewed, and 8 groups were selected for further development. These 8 concepts were then expanded into the more complete designs presented for on-line voting on 1 December.

Analysing the 8 project proposals, it was clear that all the 8 proposals were unique, but overlapping elements were visible. The winner from the public voting was CLASS IN NATURE, while RIVER, BELONGING, MARKET and TIME FRAGMENT were pre-selected during an expert's panel review for further development.

LAYER created 3 'boxes' looking out from the main classroom.

RIVER OUTSIDE THE CAVE focused strongly on a large exterior space.

FREE LOOP used the buildings to define a central courtyard with levels moving clockwise around it.

TIME FRAGMENT takes the user on a journey through the building, allowing choices along the way, in a strong story-telling sequence.

CLASS IN NATURE's layers of fences and walls was a charming reminder of the farmhouses in Hegan.

MARKET's playful round shapes and free outdoor elements earned it the CHILDREN'S AWARD, due to its popularity with the school-children in Hegan.

RIVER VALLEY's very clear concept resulted in a sophisticated design expressing the upliftment that A-Dream creates at schools.

BELONGING's flexible lightboxes stretch out from the main room, so that users can create many different spaces themselves by closing off some boxes and opening others.

At the formal university review, the 4 shortlisted proposals were confirmed and invited to present in Hegan a few days later. All 26 students worked together over the next week to improve the 4 presentations and attend the community consultation at Hegan. A delegation of 6 staff and 6 students visited Hegan Primary school grounds in early December 2015. The finalist design proposals were presented solely by the student leaders of each group, to the Huining Educational board promoting a high level of interaction of our students with our clients (A-Dream and Hegan Primary School). Over 40 Teachers, pupils, directors of the Educational board and community members were present. Students were challenged on their positions, understanding and rationale for their designs. The feedback brought back by the students formed a design development team that initiated work during winter 2015-16. A number of proposals were developed until a final proposal was reached by students and staff.

Figure 27. (Left) Engineering and Architecture staff and students (UNNC) on final round table discussions for feedback about four design proposals presented to School teachers/principal, children and Huining Educational board



Figure 28. (Right) UNNC Architecture student presenting her design team proposal to Huining Educational Board members, while Architect-in Residence 2015-6 Nina Maritz from Namibia observes their interaction.

Upon returning to UNNC, the tutors and jury involved on the design development of Gansu Studio, understood that all 4 projects were technically sound, well developed and clearly expressed A-Dream's vision. Hegan school management discussed the designs with UNNC and A-Dream staff in detail. Based on their feedback, the creativity and functionality of the designs, the jury decided to select two joint winners. The designs of these two were merged and elements of the other shortlisted schemes incorporated. Some aspects of the 4 projects not shortlisted, were also included.

Figures 29.30 Market Proposal (The Children's award)



Fig 31. Belonging Proposal (Joint Winner with River Valley)

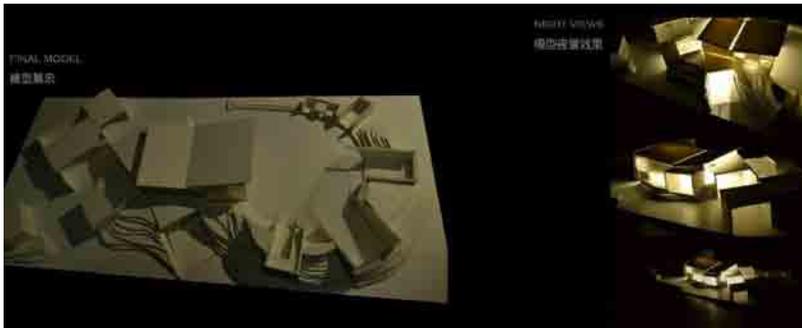


Figure 32. River Valley Proposal (Joint Winner with Belonging)



After consultation, the studio project was restructured as all 26 students worked intensively to merge the two winning schemes into one proposal to be developed for construction phase. The NAA students were engaged along with experts on environmental simulation, raw materials and structural engineering. Each student was in charge of one particular part of the project, and tutors (Architect in Residence Nina Maritz – Namibia and Xin Wang – Studio Q Shanghai) led this phase of the design process till final submission by students at the end of December 2016.

Figures 33-34 (Left) Merged drawings for selected student proposals. (Right) Architect Nina Maritz reviewing construction detailing with architecture student.



A continuous process of redesign and development took place from December till end of February 2016, where a series of developmental sketches to fit affordability and construction requirements were implemented.

Compared to Architecture students' intensive learning workshops with Architect in Residence in design studio, Engineering students have less interactive reviewing and formative assessment in classroom. Compulsory journal/blog writing through the project design development process for GANSU project was required for NAA students to enable alignment with intended learning outcome i.e. real project deliverables (Biggs, 1996; Pritchard, 2008). Students from different disciplines were actively help and support each other, also self-managed and shared tasks for assisting Architecture students to meet staged review deadlines.

As highlighted in the literature (Wong and Wong, 2009; Tal, 2011), together with analysis of student feedback and industry panel discussion, project-based learning and outside classroom activities empowered students to plan and manage individual and team learning themselves. By taking on challenges to provide/propose technical solutions on-the-spot, NAA engineering students had the opportunity to discover the interconnection of all taught principles and guides under real world time pressure as in practical

industry settings. Students gained valuable experience for enhancing their transferrable skills to contribute actively and work in a team.

### IV.3. Phase 3: NAA Research Team & Industry consultants

TADI – Tianjin Architecture Design Institute in association with UNNC signed a memorandum of understanding early in 2016, and TADI's highly qualified team of researchers and practitioners became the headquarters of Gansu Plug-in School Unit. Senior NAA students and a much-reduced team of UNNC staff worked alongside with leading Architect in Residence Nina Maritz (Nina Maritz Architects – Namibia) from March – June 2016 to deliver the final design package to be built. Permits, building consents and blueprints for construction were finalized by this deadline, with all the technical resolution necessary to materialize Project Gansu.

Figures 35-36. (Left) TADI Headquarters, with TADI engineers and architects with Architect Nina Maritz (April 2016). (Right) Final site planning for Gansu Plug-in School Unit, Hegan Primary School.



#### IV.3.1. Building Facilities, Configuration and Activities for the Gansu Plug-in School Unit

Following up from the student's merged design proposal, the team of consultants worked on further developing their design's proposals into a simplified and technically resolved design package that would be affordable, structurally sound and flexible enough to be adapted to other climatic conditions and contexts. The final designed building consisted of a single multi-purpose classroom with winter-lobby on the ground floor, an ancillary bathroom on an intermediate level and a kitchen with two basic bedrooms on the mezzanine level. This was set in a garden space with various features. The concept behind the building design was to create a simple recognisable form that resembles a child's playful drawing of a generic "house" by means of a



interior space on the south side above the classroom which could be used efficiently as for the mezzanine accommodation.

The classroom is approached from the west side, by visitors coming from the main school gate, or from staff and students coming from the school building main south entrance or side east entrance. The pedestrian crossing over the service road was placed to allow this approach. The building was then entered through a lobby in the shape of a red paper aeroplane placed on the west side. This lobby helped to buffer the indoor-outdoor temperature differential during winter. Just inside the classroom entry door, a staircase to the left leads up to the bathroom and staff quarters. The space under the stair is meant to be used for storage. There is free movement all around the building, but the main inside-outside connection apart from the main entrance are the doors on the south leading to the main play-area and permaculture mound.

Figure 38. Interior section perspective of the Gansu Plug-In School Unit



The classroom proportions of a 7.2 x 12 meters floorplan (a 6:10 ratio) enables multi-functional use which is complimented by mobile furniture.

Bookcases, tables, chairs, smartboard and beanbags can all move around to create different interior configurations. The clip-on bathroom is placed to the side to allow for the double composting chambers underneath the dry latrine. There will only be one toilet pedestal, and once the first chamber is full, the pedestal will be moved to the second chamber. The first will then be sealed, allowing the waste to compost over a period of a year, before it can be emptied, and the pedestal switched again. After a year, the waste should be composted enough to be odourless and inert with no harmful pathogens or bacteria.

By moving the tables to the side and laying the bookshelf units on their side against the east wall, a small stage can be created for performances to parents, etc. On the mezzanine, the stairs arrive at an open-plan kitchenette where the short-term residents can prepare small meals and eat. The kitchenette is to be furnished with basic equipment only, as long stays are not envisaged. The two bedrooms each contain a single bed, wardrobe and writing desk. It is meant to be used mainly for overnight accommodation and some study time only.

The ground floor classroom would be used for the following:

A) Day-to-day teaching of A-Dream courses to as many as 54 children sitting at seven A-Dream tables and working on computer tablets as well as paper, etc. The A-Dream tables could be moved around in different layout configurations. The teacher would use a mobile Smartboard as well as the north wall which would act as writing board.

Figure 39. View of spatial configuration of the main space with roof and entrance



B) Similar teaching would take place for adults (teachers and/ or parents) outside but aiming at improving teacher performance and parents' support skills.

C) Educational games, dancing, singing and performances as fun learning activities for the children (the tables would then be moved to one side) would take place in the classroom as well. These more physical activities result in improved concentration and active learning.

D) 600 mm high bookshelves along the north and east wall would be stocked with children's books, computer media and teacher training manuals. Colourful beanbags would provide relaxed and moveable seating for the readers in various corners of the room depending on the furniture location at the time.

E) Against the west wall, 4 computer stations provide computer and Internet access for the school's teachers and would also be used during teachers' courses to improve teaching skills.

The mezzanine accommodation would be used as short-term overnight accommodation for:

A) Visiting trainers who come to upgrade A-Dream training and teacher skills during short courses.

B) Volunteers recruited to teach English during short periods (A-Dream/UNNC-UNUK-UNMY)

C) Teachers' visiting from even more remote schools to be introduced to A-Dream as well as be trained to apply the A-Dream enhanced

D) Researchers/students from UNNC taking part of undergraduate or postgraduate work at UNNC/UNUK/UNMY and that can have projects related to community development/school community.

The outdoor area supports the following activities:

A) The existing school pavilion garden would be expanded into a food garden, as part of the teaching of sustainability.

B) Two small “hills” to the north of the classroom would be planted with fast-growing trees as a miniature reforestation example. It would also act as a wind-buffer to re-direct cold northern winds over and around the building. The south-facing slopes would provide seating as a small amphitheatre using the classroom as a backdrop for the open area in front.

C) On the west, a small paved plaza in front of the entrance would be linked to the school’s main entrance plaza with a pedestrian crossing in the form of a speed-bump, to ensure the safety of the children as they would cross the school’s service road. Although the traffic there is minimal, it would also help to train the children in road safety.

D) The open area to the south of the classroom would be the main outdoor activity and play- space for A-Dream activities. The spiral mounds lowest ramp and retaining wall would be included as seating and podium elements.

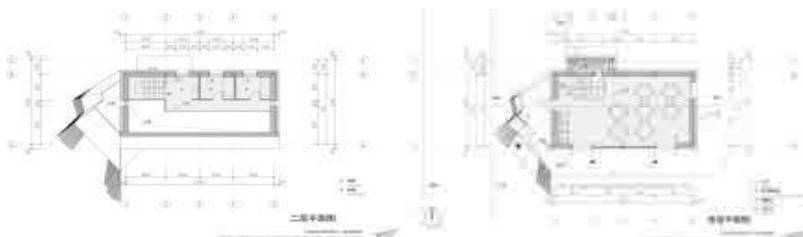
E) The spiral mound or “mountain” on the most southern part of the site, is a reference to the mountains of the area, a recurring theme in most of the student’s design proposals and would be used as a permaculture cultivation spiral, which maximises vertical space in a restricted area to allow plants access to light and sun. This would be minimally irrigated by means of harvested rainwater and recycled grey water. The emphasis would be on drought-resistant plants.



The ornamental garden was partially re-purposed as permaculture food garden and adventure playground. The design of the building aimed at maximum flexibility, with interior walling being removable and easily adjustable. Replicability was provided for by the standard steel structural framing, which could then be clad in different ways depending on local climatic needs and local materials available.

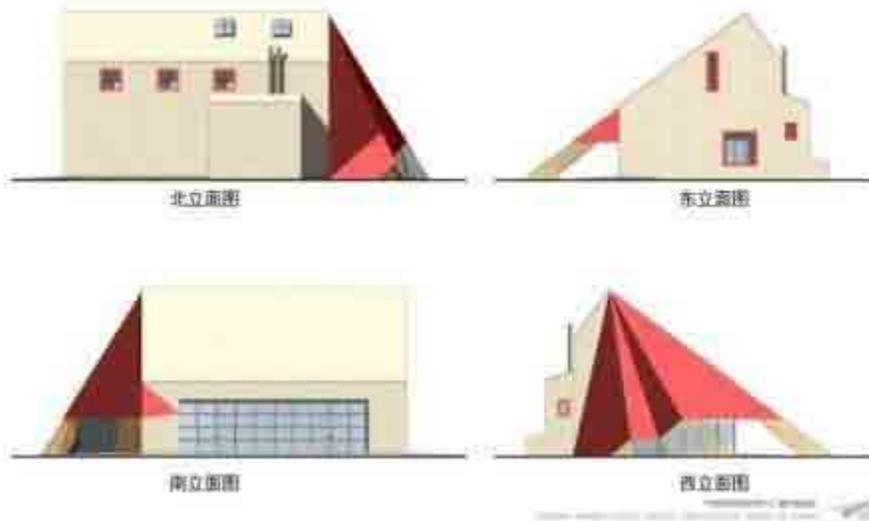
The primary approach taken with the sustainable design of this building was to focus on passive design methods, with active only added where passive could not handle the climate extremes. This was done for two reasons – firstly that passive is a more financially economic solution both in terms of capital and running or maintenance costs, and secondly that the project could demonstrate passive measures to the local rural low-income residents.

Figures 43,44. Plan (left) ground floor and (right) mezzanine floor.



However, as the local climate extremes are considerable, various active interventions had to be provided. The building is thus a hybrid solution aiming at primarily low-tech solutions, enhanced by high-tech where appropriate (such as solar PV, LED lighting, etc.). Passive design features include optimum orientation to the south, with the building elongated along its east-west axis. And the roof-pitch is at the optimum solar angle of 36 degrees. The south façade is almost fully glazed, to provide maximum solar gain in winter by heating the thermal mass of the concrete surface bed of the ground floor. The adobe walls provide additional thermal mass.

Figure 45. (top left) Northern façade, (down left) Southern Façade.( Top right) Eastern façade (Down right) Western façade



Windows on the south side and the mezzanine north sides provide cross-ventilation in summer, when the sliding screens on the mezzanine walkway are open. No artificial ventilation would be required during the warmer periods. It is expected that daylighting would provide all interior lighting needs during classroom working hours, in combination with the reflective white ceilings spreading the light indoors. The entire building was insulated – under the concrete surface bed, outside the steel frame and adobe, and below the roof-sheeting.

A complete solar PV array on the rooftop, plus additional Solar PV panels on ground-mounted structures is expected to meet all power needs, including hot water, space heating and ventilation. Underfloor heating for the ground floor would be provided through a hydronic system, with the mezzanine floor heated by radiators. A heat exchanger in the ceiling above the staircase would warm incoming fresh air in winter. All light fittings would be using energy-efficient LED's.

As Heban is in such a dry area and water supply is low, the double ventilated pit latrine composting toilets would reduce the water requirements significantly. Added water requirements would be for the guest shower and wash basin, as well as the kitchen sink. The minimal grey water produced would be recycled as garden irrigation. It is envisaged that this would be supplemented by rain-water tanks underground.

Due to earthquake concerns and local regulations, the design had to be changed from a load-bearing adobe structure to a steel structural frame with external insulation. The initial aim of using low-embodied energy materials with high local content and minimal toxicity thus had to be modified.

Figure 46. Southeastern view of the Gansu Plug-in School Unit



人视效果图 (一)



#### IV.4. Phase 4: Fundraising and Delivery

Following up the nomination of Gansu Project as LifeCycle 5 China in September 2015, a committee was formed to develop marketing and fundraising activities to achieve the necessary funds to complete design development and construction phases for the project at UNNC. As the first fundraising campaign of its kind at the UNNC, the challenges were substantial. The combination of reduced number of full time staff with the marketing and public relations expertise, the lack of fundraising experience in China by the management team, difficulties with language barriers and lack of knowledge of the Chinese context, aligned with strict regulations in China for fundraising proved to be very challenging. By the end of summer 2016, the design experts had reviewed and merged all the design proposals and delivered a highly sophisticated and technically complete design package as requested by the Educational Foundation and Party Committee from UNNC. However, only half of the necessary funds for construction had been allocated or fundraised

to the Gansu prototype. A decision was made by the top UNNC management to stall Gansu construction plans and redirect the fundraised money to Hegan Primary School and to A-Dream Charitable Foundation.

Figures 47, 48. Fundraising campaign for China Life Cycle 5, website and flyers, 2015-6 – UNNC, Ningbo China.



A number of events were organized as part of the LifeCycle 5 Fundraising Campaign, such as the ‘Danzando Recital’, a concert performed by students and staff from UNNC (Figure 49). The Dongqian Lake Cycling event and the Life Cycle 5 Public Lecture Series were also part of the series of events that involved the UNNC community on campaigning for quality of education in rural areas. All were first of its kind at UNNC, with a substantial number of students and staff contributing to enhance a culture of engagement and participation at UNNC. These events have been enhanced and continued throughout the LifeCycle 6 and 7 campaigns carried out by UNNC.

Figures 49,50,51. (Left) Musicians at the Danzando Recital (December 2015). (Middle) Cyclists at the LifeCycle5 fundraising event in Dongqian Lake, Ningbo (Right) Flyer for LifeCycle 5 Public Lecture Series.



## V. Project Outcomes and Student Testimonials

Despite the lack of funding to complete the construction of the project by UNNC, Gansu studio remained as a very important experience, unique for the students, staff and community that took part. It is still very possible that other institutions however could take the idea and model for development, and the technical team would be well positioned to advise on how to adapt the work to another community and location. The experience gained, and the lessons learnt were invaluable to all involved.

The Hegan Primary School Plug-In Unit has been designed to be the first positive energy rural school building in China producing an estimated 18304 kWh/year of renewable energy to the school unit and reverting back to the Hegan County grid an annual extra clean energy 2304kWh/annum. The school would save an estimated 22 tons of water per year, amongst with aiming at integrating a deep understanding of local contextual existing resources and available technology for improvements on sustainable behaviour and integration into school curriculum practices and community development.

From its original brief, studio Gansu was designed as a pilot project at many levels:

- 1) First educational rural green building design in China to be certified upon completion: (Chinese Green Building Standards, and BREAAAM UK). It aimed to encourage sustainable practices, influence its school curriculum and serve as a demonstration building for the local community.
- 2) First designed/customized A-Dream classroom (designed with the possibility of roll out at its 2,000 schools, participating on its current activities) to engage with its programme of enhancing holistic and creative education at primary schools in China.
- 3) A-Dream and UNNC programme for Gansu project was a unique partnership that has provided opportunities for higher quality education for UNNC students being part of a real context for development of critique/ideas and real solutions. It had also provided a set of opportunities for UNNC, A-Dream and Hegan Primary school to engage with the design ideas and proposals for integrative and creative education.
- 4) A unique student centred pilot scheme within UNNC, to engage students and staff from 5 disciplines providing extensive network

of mentorship, internships for students on real contexts, framing environmental sustainability and social responsibility. A real engagement with communities, industry partners and private and public sectors.

If it had been built, Gansu Plug-In School Unit, on top of all the above outcomes which had been delivered, would have contributed towards demonstrating and developing building systems and standards for raw materials such as adobe. A well-known technique in the past, used extensively in the region, which is environmentally friendly, locally sourced, affordable and accessible by locals, but disregarded because of the lack of building codes and the lack of local or professional knowledge on how to improve performance (structural and thermal). The earth and adobe are a fundamental part of Gansu and Heban, as a place and as a culture. It is important that it remains, and it contributes towards the construction of a modern and prosperous community.

### V.1. Student Testimonials

I had to put a lot of thinking before I joined any unit for my 3rd year here at UNNC. The Design for real unit being conducted for the first time, was a challenge and something new to me. I was well aware of what I had to sacrifice before I joined this unit. However, the benefits I gained from this unit are immeasurable. Being able to work in a studio led by world renowned architects exposed me to real life architecture. Project Gansu helped me to experience how a firm handles a project from the very beginning till the end facing all challenges. The most important lesson I learnt is how to work as a team on a professional level. Working with my colleagues on the same project for one semester was not easy. Listening to each other's opinions and views aroused many unending arguments which we managed to solve as professionals with the help of our tutors. This unit gave me a better understanding of what real architecture is and changed my thinking pattern and approach towards architecture (Dinal Batapaththala, Architecture – year3).

I started this project in October 2015, primarily, I just wanted to utilize what I have learnt from my four years study to see how I could be involved into a real project. But I found that it is not just about designing and constructing a building. This experience allowed me to know how the real work is operating and how to communicate with other workmates in the future.

I also learnt how to organize and manage people together, and how to plan the schedule for each step of the project as an assigned team leader (Juntian LOU (6509552), AEE – year4).

I have enjoyed participating in this project as an International Communications Studies student. I can see that this project contributes to many groups of people: The kids in Heban Primary School, the students in UNNC, and also, the society as a whole. We have learned a lot while doing it. Architecture students could learn something in their domain. But for me, as an IC student, I have also learned a lot such as collecting multiple views toward this project and made us think deeper about it. The module convener and supervisors in this project are helpful to us that leads us make the most of our capabilities. I am looking forward to seeing the progress of this project and contributing more it (Qianying FAN Film studies - year3).

What I was able to learn with Gansu project was the excellent teamwork with people from different majors with one clear goal, which is to design one classroom for children to access the better-quality education. For me as an AEE student, I learned how to work with simulation of the building services performance by using software and have the knowledge of building energy savings. The project required the interactive teaching and learning between students, which is very valuable and positive. On the other side, this project also leads me to find the direction of further studies, career and professional development. In brief, I really appreciate the opportunity to be engaged in Gansu project (Mingxuan ZHANG, AEE – year3).

## VI. Concluding Commentary

Project Gansu was never built, and it is likely that it will never be. It started as an imaginative idea, as a discussion between two staff members back in 2014. As we speak, it is a tangible and well developed creative and innovative project, with clear goals and feasibility to serve as an extended presence for institutions like UNNC. Institutions that would have a goal to take a stand for the delivery of high quality education and simultaneously against inequality in China.

Project Gansu was not incidentally based inside a Primary School. A school is said to be the core of a community. A school should not be only open to children, but should be a joint collaboration between teachers, students, parents and community in general. Project Gansu was not incidentally based

at a Higher Educational provider like UNNC. It was there because those involved on its technical and creative development, staff and students aimed at making their Institution a place famous for providing an education which is synonym of critical thinking and innovative solutions that can benefit society as a role, that can create richness and be resourceful with graduates that are highly ethical and innovators.

They had a vision first and foremost that higher education should not be a jargon where well-off citizens gain highly and prestigious paper awards for careers directed only towards individual financial gain.

The possibilities offered by such simple complementary prototype model of education were many, as it used little physical resources but connected primary and higher education to promote exchange knowledge, increase research capability and promote and deliver developmental outcomes.

Those involved imagined something that has never been done before, never existed and the realization of these kind of projects is not an easy task. We have set up a complex network of public and private partners, considering a real context, involving 5 different disciplines, within an academic institution. Disciplines that operated on a very different way, with different management routines. All of this, with the purpose to allow our students to bridge their own realities, to see beyond their own experiences and experience more and better understand and expand their abilities for making and thinking. To think creatively and to be able to advance new ideas, one needs to be motivated, take risks, think laterally, and collaborate. This project was as much about its tasks and skills and brief, which are field specific, as it was about building professionals that are engaged and are caring on how they affect one another, their surroundings, how they relate to one another, be it at UNNC, Hepan or anywhere else.

Most of our students have never lived or visited a rural area in their entire life. As much as we talk and write about an urbanized China and the whole world becoming 'urban', there is today at least over 600 million people in this country that do live in rural areas and another significant migrant urban population that do have strong links with rural environments by their relatives, young children or elderly parents that are left behind. And their living conditions and opportunities are very different and will still remain as such for some time, as development has taken directions that are not prone towards equal opportunities when considering rural and urban living in developing nations, exacerbated in China. Our students have never known that China could be so different and yet so near to them, and they realized they needed to know more, and ask questions. Being at Hepan was for some of them a life changing experience, as they met with the people, the teachers,

the children and they left behind their own pre-conceived ideas and realities and were prepared to embrace and be embraced.

They have new realities now, which is a construction of what they have experienced, they have seen and have learned through the community they have been in touch and they have also touched them by their work. Some of our students have their own ideas and answers, they have thoughts on how their futures will be shaped, and this experience has contributed towards these thoughts and their plans. This project has been in its totality designed by students and staff from UNNC and external partners, with the support of admin staff from UNNC and UNUK. Even though the window for its physical realization has ended, the experiences and knowledge encountered was real. And we only hope that this can inspire our students to continue with the pursuit of improving their own realities, and by doing so, are meant to be more inclusive, fair, ethical, creative and environmentally aware of oneself and others.

Many people try to achieve something in the realm of thought, but they give up when difficulties arise. Only those persons who have visualized their thoughts very strongly have been able to manifest them in outward form... Achievement lies in continued regularity of activity —Sri Paramahansa Yogananda.

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