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__BÀI BÁO KHOA HỌC__

SENSUAL ACCESSES TO CHEMISTRY♣
(PART 1)

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ABSTRACT

The "German Festival 2017" was coordinated by the German General Consulate of Ho Chi Minh City. This event has been realized by different German hosts and supported by important German enterprises. Of course it was an occasion to illustrate and to transfer German ideas for Vietnam also concerning educational ideas in general and in particular for chemistry education. Scientific literacy is important for the future society. In this meaning it is necessary that conveying through education system and school needs to extend by public events. The project "German Festival" shows, in how far Chemistry Methodology can be taught at university. A "Didactics of Chemistry Methodology" must create possibilities for students to co-design didactical learning contents by their own knowledge, emotions, imaginations and meta theories. Individual insights will be developed by their experiences. This researching approach is successful. Knowledge of chemistry methodology will be acquired in a meaningful way. Cognitive conflicts between individual imaginations and experienced reality are learning impulses.

Keywords: Research in Chemistry Teacher Training, Out of School education, Intercultural Education.

TÓM TẮT

Tiếp cận Hóa học qua giác quan (Phần 1)

"*Lễ hội Đức được 2017*" *tổ chức bởi Lãnh sự quán Đức tại TP Hồ Chí Minh. Sự kiện này được thực hiện và tài trợ bởi các doanh nghiệp và tổ chức Đức. Đây là một cơ hội để thể hiện và truyền tải những quan niệm của người Đức đến với Việt Nam cũng như sáng kiến về giáo dục nói chung và giáo dục Hóa học nói riêng. Giáo dục khoa học rất quan trọng cho xã hội tương lai. Trong bối cảnh hiện nay,việc truyền đạt kiến thức từ hệ thống giáo dục và nhà trường cần được mở rộng qua các sự kiện công cộng. Dự án "Lễ hội Đức" minh họa một cách dạy học Phương pháp dạy học Hóa học (PPDHHH) ở trường đại học. Môn PPDHHH phải tạo cơ hội cho sinh viên, giúp họ hình thành nội dung học tập qua những kiến thức, cảm xúc, sự tưởng tượng, siêu nhận thức cá nhân. Những hiểu biết cá nhân sẽ được phát huy qua những kinh nghiệm. Tiếp cận nghiên cứu này sẽ mang lại thành công vì kiến thức về PPDHHH sẽ được thu thập một cách có ý nghĩa. Những cuộc xung đột nhận thức giữa tưởng tượng cá nhân và thực tế từng trải là một động lực học tập.*

Từ khóa: nghiên cứu trong đào tạo giáo viên, giáo dục ngoài giờ lên lớp, giáo dục liên văn hóa.

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Basics of this Education Project

The article documents first of all activities of Chemistry teacher students from the Ho Chi Minh City University of Education in an out of school education context. The students had the opportunity to test, to apply and to reflect their methodological and special knowledge. The students *Anh*, *Anh Khanh*, *Linh*, *Minh* and *Nhon* has been involved in an intercultural overall situation. The German Festival, organized by the German General Consulate Ho Chi Minh City, took place on the 22nd of April, 2017 in the Saigon Zoo and represented German cultural achievements for the Vietnamese community – also for children and youths. The goal was to promote Cooperation between Germany and Vietnam on various cultural sections. The Department of the *Ho Chi Minh City University of Education (HCMUE*) has used the potential in order to present in public: In the frame of his guest professorship of at the *HCMUE Prof. Dr. Becker* could present higher education didactical perspectives from a German view in cooperation with Vietnamese students. The Equipment has been provided by the *International German School Ho Chi Minh City (IGS)*, represented by the chemistry teacher *Quang* (doctoral student of *Prof. Dr. Becker*). Through this and through his long experiences with out of school nature science activities he enriched this joint education project in every respect.

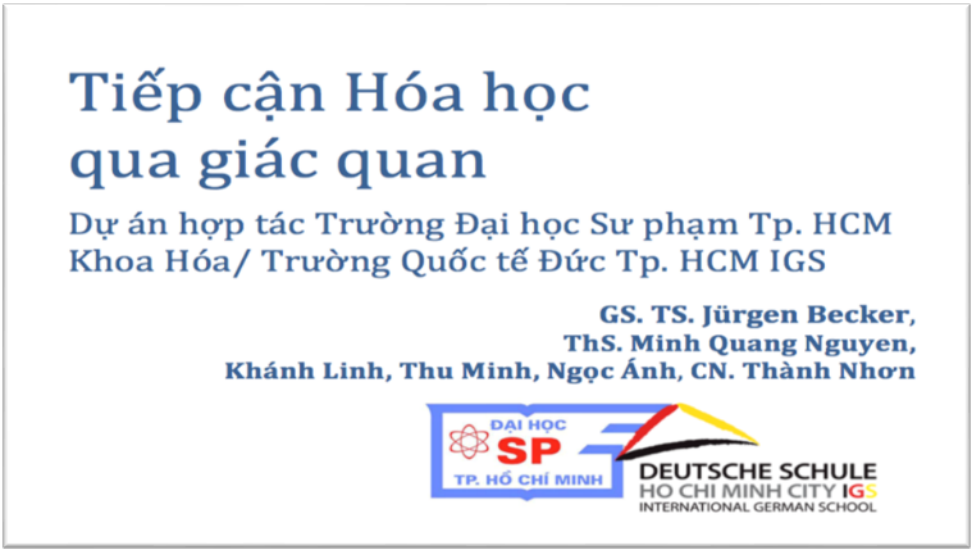

Figure 1. *The Flyer: Sensual approaches to chemistry at the "German Festival 2017"*

Meaning of Chemistry Education

Nature science education in general and chemistry education in particular make an important and differential contribution to developing the Vietnamese society. This has been fixed in the education law (National Assembly of Vietnam (K.11), 2005, §28). Beside holistic social tasks, e.g. concerning environmental problems and behavior, potentials must be used in order to contribute for "individual" personality development. Especially – but not only – the Vietnamese Methodology is urged for

- effective implementing education policy strategy,
- verifying and improving them,
- researching education processes and
- conveying this in teacher training.

Education law and reformation programs fixes "modern" education policy initiatives and commands explicitly to be receptive for modern, international developments, e.g. by out of school chemistry teaching and learning processes in order to contribute to general chemistry education and therefore in order to discuss in a constructive and critical way. It is expected that reflections about chemistry education will be useful for developing the whole society and it will help improving the image of nature science or chemistry. Considering current social and public challenges those developments are urgently necessary.

Meaning of Chemistry Methodology for Students

Research efforts of the methodology must consider chemistry education processes in a systemic way and therefore also education situations in out-of-school environment. So called Science fairs are a methodical alternative for implementing these goals. In an elementary perspective young learner get involved into playful activities. Their natural actions, handlings, imaginations, ways of thinking let them participate on science fairs in an self-activating and autonomous way, while they get unconsciously access into chemical phenomena: Children will be slowly introduced to chemical imaginations. Such education activities can be supported by superior events, like the German Festival. They are effective as good publicity by versatile promotion.

A perspective of research will be stressed, when sensual everydaylife experiences of learners enable interpretations, problem solutions or prognosis - in an elementary epistemic meaning. behavioristic incentives (prizes) may stimulate the research process. Abstract structures should be set up by sensual experiences. BA- and MA-students experience this theoretical insight through direct participation in education situation concerning planning, preparing, conduction, Analysis of the whole educational activity. Our principle didactical orientation should also be transformed into education processes in schools. From a higher education didactical view such experiences are learning efficient, therefore motivating, close to reality and from education policy perspective explicitly legitimated (Becker, Nguyen, 2014, p.18-28).

Legitimation

Intercultural aligned, children activities concerning chemistry illustrate education situations from another cultural circle. In Germany they are in diverse distinction common and they are supports by government, universities and public community. At the German Festival the activities has been integrated into other German culture representations from Technology, ecology, economy, society, education organization and system.

Thoughts concerning planning, conduction and reflection of the education initiatives has been discussed **bilingual** or **trilingual** (multilingual) and therefore intercultural has been realized by lingual diversity. Switching between the language levels "Vietnamese", "English" and "German" was necessary when language conditioned meaning imaginations of specialist terms needed to be cleared and or when cultural conditioned connotations of the specialist terms needed to be mutually negotiated in discussions. Linguistic differentiations made it possible to overcome and understand aspects of a complex factual connection concerning methodology, chemistry, education, organization in a foreign language. Not least the participants has trained their translational qualifications (Becker, Kemper, Nguyen, 2017, p.375-382).

From a **higher education didactic** perspective students have learned appropriate conceptual arrangements and chemistry didactical contents in the frame of the guest professorship of *Jürgen Becker*- in special some lectures to **pupil orientated chemistry teaching** (Becker, Nguyen, 2013, p.38-45). The Vietnamese students had the opportunity to apply, to overlearn acquired Qualifications and to professionalize behavior in action contexts. In addition the students could evaluate acquired theory on the background of their practical experiences. At least they could hermeneutically interpret the co-designed praxis on the background of their previous experiences that means comparing and eventually changing their structure of knowledge. The cooperation with *IGS* has enhanced the effort bringing practical teaching experiences into education contexts in a participating way. Overall the conditions for research activities in teaching are given: Students rediscover findings, them in educational reality, verify theories and test themselves. They design researching processes in teaching situations or possibilities. In special in these connections the pupil oriented approach will be illustrated in a students oriented way at university. Through this knowledge will be exchanged in the meaning of knowledge enhancement. *Jürgen* has been realizing and researching this approach for a long time. He has published many articles in cooperation with students (Becker, Schürer, Sieg, Hildebrandt, 1993, p.31-33; Becker, Maaß, 1995, p.58-70; Becker, Lehmann, 1997, p.59-69; Becker, Hildebrandt, 2000, p.84-86; Becker, Deperschmidt, 2006, p.113-120; Becker, Labahn, 2007, p.320-324; Becker, 2010, p.98; Becker, Folwaczny, 2010, p.35-38; Becker, Nguyen, Parchmann, 2015, p.364-368). It seems that such approaches are required at the *HCMUE* (National Assembly of Vietnam (K.11), 2005, §39f).

The pedagogical and didactical handling contexts have also an effect on **personality development** of the students in a holistic view. They encourage autonomy, self-confidence, self-assurance, responsibility. At the same the students are socially integrated in this entire situation. Their creative skills, fixed goal and formulated task of education processes (Nguyen Thi Diem My, 2017, p.70-75) can be demonstrated much better than by usual performance assessment. In the meaning of self-assessment the students rely on the

real handling situation that is individually valuable. They recognize possibilities of methodological research processes and discover consequences of an action research as a chance in their professionalism. It is possible to get direct - by instruction - experiences with heuristic characterized data collection and hermeneutic interpreting methods.

The children activities take place in a public location in terms of the European movement ***science on stage -*** a world wide movement. The intention is to improve the **image of chemistry** and a nature scientific world view especially for the children and young students. Furthermore they should initiate **emotional** attention and enthusiasm for cognitive oriented handling interests that means to awaken interests for chemistry and nature science in general. Education must use the possibility to take phenomena out of the daily life and to bail out their sensual potential as an access to scientific special knowledge. **Science on stage** has also a perspective for **scientific literacy**. Altogether the German Festival should strengthen the **Image of Germany**.

Pedagogical contact in the frame of staged and complex education experiences offers for all education actors personal impulses in order to reflect the teachers profession in a **value oriented** and **value orienting** way. This legitimation mustn't be underestimated, but it seems that the academic teacher training neglects this. Each participant at the German Festival has a differentiated view on that depending on the occupational biographical development. Pupil orientation is an outstanding awareness and leads to regarding chemical learning processes in teaching as well as to sensitizing and concentrating for differentiated educational progresses.

Guiding principles and arrangements of our conception

Educational ideas

Chemical terms such as analysis, substance composition, materials property, synthesis, scientific methods and others are illustrated, exemplified and handily displayed by simple experiments. These basic chemical terms are experienced in a operational way, that means they are accessible, defined and realized by action. It is not primarily necessary to name or to convey them. But in the frame of our activity we have decided to announce the term "substance" as a general term for everydaylife materials and to fix the term as base for the collective communication. From a chemical view material oriented imaginations of the term "substance" are tentative. Therefore imaginations and skills of the learner concerning handling with everydaylife substances are the base for accessing chemistry.

Everydaylife phenomena are accessible by sensual skills. As inherent skills these analysis techniques are very suitable for young learner. Today they are still needed for olfactory food quality evaluation or for sensorial techniques in a standardized way. We have decided that the children should approach to phenomena through seeing (soap bubbles), touching (solid daily life materials), smelling (complex smells of foods).

Sensorial testing by tasting are generally problematical for pedagogical education processes. Therefore we have abandoned those but with this a great potential has been wasted and a possibility for approaching substances has been blocked. From the perspective of *Minh* a meaningful education process must regard the perspectives from children and young learners and they must tie on their natural given potentials. That means giving young children possibilities to make aware of substances/materials through phenomenological evaluation by sense organs. Therefore sensual activities are exposed as principle chemical activities. They can be developed and formed in the long term into chemical operations through educational processes. Smelling and seeing as natural acting have a useful function in daily life in order to realize and estimate everydaylife situations like evaluating water or air quality. This is a important aspect in order to change behavior in everydaylife.

From a German perspective out of school education ideas are numerous and versatile. Professional level and aspiration vary widely. There are to extremes. On the one hand so called Children Universities convey young learner chemical facts in an academic style and on the other hand out of school events orientate on conditions of young learner concerning interests and behavior. Science on stage is movement that represents both points on a "stage". We combined the typical European science on stage - idea with a science in front of the stage – scenario, that means activities "in front". Both moments are connected in acting, while the audience get insights for experiences *(comp. Attachment 1).*

Educational scenario in planning, preparing and realizing

Our educational intention has been prepared, put into action and recapped. It was integrated into a academic learning situation about out-of-school education arrangements and methodological study context. The students voluntarily participated with a lot of ideas especially considering the intercultural overall situation. A brainstorming as the beginning of the planning phase has considered necessary technical-materialistic aspects such as purchase, production, arrangement and needed materials as well as detailed processes. Medial and also methodical decisions have always been regarding legitimation aspects. Concretizing and experiencing Goal-Methods-Relations have extended typical methodological perspectives of Theme-Methods-Relations. This was one of the conclusion of the Vietnamese students. All activities concerning the education event has been organized as a work-sharing project concerning responsible tasks and reflected experiences. Therefore team working was demanded. Especially the phase of analyzing was very effectual considering collaborative skills (Becker et al, 1992, p.181-191). This is a part of social learning process (Becker et al, 1992, p.265-274).

The educational environment can't be compared with normal educational arrangements, so the argumentation of the students *Minh* and *Nhon: "**First,** the project took place in the Saigon zoo at weekend. Most of people, especially children went there to*

entertain and spend time together. In addition, the project was performed in a cultural space where has a lively and cultural atmosphere with cuisine, commerce, entertainment, etc. In that situation, people tend to come to experience something new and peak their curiosity. Therefore, they completely felt free, joyful and did not bring the mind of the learners. The knowledge would be discovered by chance. Perhaps they even did not know that they have learnt something about chemistry. ***Second****, the installation of the equipment did not follow the traditional education environment. The activities are organized in an open space that everyone can visit easily, even they can just observe what happens. People could come, inspect and decide whether to join or not. Parents could not force their children to participate as formal education but encourage them until they was ready…In case they did not join in, they could just look at what the others do and ask some questions about everything. And* ***Third,*** *the arrangement of the experiences was created. The experience was hold as a game that inspired the interest and curiosity. Guiders introduced the experiences as a game but not a lesson. It means organizers did not tell something about what will be learnt from the game, so that people participated in with the mind of a player or explorer. Chemistry terms did not mentioned in the experiences although what they doing was the way scientists do their researches.*

There were two main activities in the project. The one that participants sense matter by touching and smelling was arranged inside a tent as a stage. People could join in not only individual but also in group. It's important for family members or friends to explore and to have fun together. This also helped to remind each other about the previous experiences. Beside the tent, also in front of the stage, there is an empty space where the other activity was placed: producing of soap bubbles. Adults and children could try to make bubbles by themselves. The unlimited space created a comfortable feeling and allowed people to sense by sighting without doing it. Everything that happened was based on the natural feelings and needs of participants.

At the outer wall of the tent, there were pinned many pictures of our previous activities (comp. Attachment 1 and 2). People passing by the tent could know the name and saw these pictures to understand more about the project. Participants comprehended the spirits of the project through enjoying the pictures."

And in addition the Vietnamese students *Minh and Nhon* point out: "*The aim of competition was to give young children (about 4-10 years) possibilities to approach science or chemistry in a playful way. The chance of winning a prize should help motivating them more. Children in the mentioned age have an developed awareness for their surroundings and phenomena in their daily life. In order to improve sensual skills as natural researching tools (see above) we have prepared suitable simple research tasks. The participants should use their senses of smelling (lemon, coffee and soap) or touching (wood, glass) in order to identify everydaylife substances and materials in a 'black box'.*

The children should have experienced and they should remember the aroma or surface of these substances and materials. So they would be able to answer the research tasks concerning smelling and feeling. On an answer sheet (Figure 2) several answer possibilities have already been given. The children should mark right answers with a cross". Considering the differentiated developed reading and writing skills of the children the possible answers were illustrated as pictures and at the same time as bilingual terms in German and Vietnamese. By this the participants might also train language skills. The answered questionnaires of the participants has been collected. Six of the correct answered questionnaires have been cast lots. In order to attract children and parents for the research tasks we have organized prizes related Germany and German culture: Vouchers for German classes at the International German School (IGS), German memorabilia that might be suitable for the children."

Figure 2. *Answer sheet*

The composition of the answer sheet has been discussed in our planning group. Answers has been given as pictures (*Figure 2*), because it couldn't be estimated, if and in how far especially the young participants could "write" the terms. At the same time "journalizing" of the natural scientific cognitive act has been standardized and alleviated by marking with crosses. Of course the answer alternatives have provided a decision help for those participants, which were indecisive. But through this discrimination skills of the participants have been requested. The participants had to decide actively cognitive-oriented between six answer alternatives for the smelling activities and four for the touching

activities. Our concept was described by a poster on the stage that was read by many visitors (*Figure 3)*.

Spielerischer Umgang mit **Stoffen** ist eine natürliche Möglichkeit, um Kinder an chemische **Phänomene** heranzuführen. Chemische Begriffe wie **Analyse**, **Zusammensetzung**, **Stoffeigenschaft** u.a. werden durch einfache **Versuche** illustriert. Sie regen Lernende zur selbstständigen Arbeit an. Die Fähigkeiten der Lernenden im Umgang mit Alltagsstoffen sind Basis für Zugänge zur **Chemie.**	Playful handling with **substances** are a natural possibility for children to approach chemical **phenomena**. Chemical terms such as **analyze**, **composition**, **properties of substances** et al. will be illustrated by simple **experiments**. They stimulate learners for autonomous activity. Learner's handling skills with everydaylife substances are the basis for an access to **chemistry**.	Sử dụng các **chất** khi vui chơi là một cách tự nhiên để trẻ em tiếp cận với các **hiện tượng** Hóa học. Những khái niệm Hóa học như **sự phân tích, tổng hợp, tính chất v.v.** có thể được minh họa thông qua các **thí nghiệm** đơn giản. Nhiệm vụ chính là thúc đẩy người học làm việc một cách độc lập. Năng lực xử lý các chất trong cuộc sống hằng ngày là nền tảng để trẻ tiếp cận với **Hóa học.**

Figure 3. *Info box: Conception of the education activities in German, English, Vietnamese (poster at the outer wall of tent)*

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Attachment 1

From 1999 to 2015 the working group Jürgen Becker (UPB) has realized many out-of-school education activities for young learners. The topics are versatile: https://chemie.uni-paderborn.de/arbeitskreise/didaktik-der-chemie/akbecker/lehre/. Experiences about that have been published and they have often been starting points for several scientific activities in the frame of dissertations.

Attachment 2

Many out-of-school education activities at primary and secondary school in HCMC with the topic "Simple Experiments in Everydaylife" – in cooperation with the Department Chemistry *HCMCUE* in fall 2015.