CHEMISTRY TEACHING AND SCIENCE OF EDUCATION IN GERMANY
PART 3: OUR EXPERIENCES AGAINST THE BACKGROUND OF OUR CHEMISTRY DIDACTICAL UNDERSTANDING

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ABSTRACT

This article summarizes the main ideas of our lectures at the Ho Chi Minh City University of Education (HCMCUE) in February/March 2013. It is about aspects of chemical education, goals and problems of chemistry teaching in Germany and the importance of a sustainable and meaningful chemical education. This article is the third part of three articles dealing with the main ideas of our lecture at HCMCUE. While the first two articles dealt with aspects of chemical education in Germany and problems of chemistry teaching, the third one is about our experiences and our impressions when we lectured at the HCMCUE.

Keywords: chemical education in Vietnam, education system of Vietnam, didactics of chemistry.

TÓM TẮT

Giảng dạy Hóa học và Khoa học giáo dục

Phần 3. Các đặc điểm của việc giảng dạy Hóa học ở Đức

Đây là bài báo thứ ba trong loạt ba bài viết trình bày tóm tắt các nội dung chính trong các bài giảng của chúng tôi tại Trường Đại học Sư phạm Thành phố Hồ Chí Minh (ĐHSP TPHCM) vào tháng 2 và tháng 3 năm 2013. Trong khi hai bài đầu nói về những đặc điểm của việc giảng dạy Hóa ở Đức và các khó khăn của bộ môn Hóa học thì bài viết này nói về các kinh nghiệm và những ấn tượng mà chúng tôi có được khi giảng dạy tại ĐHSP TPHCM.

Từ khóa: giảng dạy Hóa học ở Việt Nam, hệ thống giáo dục ở Việt Nam, phương pháp dạy học Hóa học

1. Our thinking

First of all we would like to introduce our positions. Based on them we will handle our impressions. To be honest we cannot estimate if our perspectives are appropriate to the Vietnamese situation:

- Methodology of chemistry in general understanding is a subtask of chemical

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didactics. Methodology accents especially teaching aspects. This differentiation is probably caused by different imaginations of meanings of "methodology" and "didactics" depending on culture.

- No chemistry lesson is equal worldwide. Methods might be but the differences of chemistry lessons are big and various: other pupils, other curricula, other cultural influences, other material conditions, other teacher training, other forms of organizations and therefore also other chemistry teachers.

- Didactics of chemistry is knowledge and understanding about chemistry lesson and scientific literacy. Teachers need this, of course chemistry knowledge and experimental skills. We see didactics as a tool, e.g. understanding of pupils, teacher behavior, legitimation, intentions and methods.

- We prefer a chemistry lesson, which is situationally created and not only planning-prepared. So teacher can better react individually on learning processes than by realizing fully planned and structured lessons.

- Chemistry teachers should also see teaching as a research task and diagnose effects against the background of the fixed lesson prognosis. So following lessons should be improved. Planning models, describing teaching, will be open and revisable.

- Pupil orientation means primarily, to link to needs and potentialities of learners. This facilitates acquisition and understanding processes. And secondarily it means to teach useful knowledge for pupils' future. This sounds easy but in fact it is very difficult. In fact this intention doesn't succeed like it should - worldwide.

- As a teacher trainer I've got the claim to convey that chemistry teaching must always be constructed and of course realized by teachers by themselves. Therefore I have reconstructed the thinking of teacher students about chemistry teaching with the aim to sensibilize students for situated teaching. For most of the students this is a new imagination of teaching. They have never reflected about this. But with this autonomous behaviour will be initiated for the later work. This is a didactical challenge for the trainer teaching in a dialectical way.

- In general didactical teaching principles have priority over didactical programs while executing chemistry lesson. They concentrate didactical rules for pupil orientated learning (e.g. in principle of being close to real life, elementariness, activation, suitability to everyday life).

2. Our experiences on local

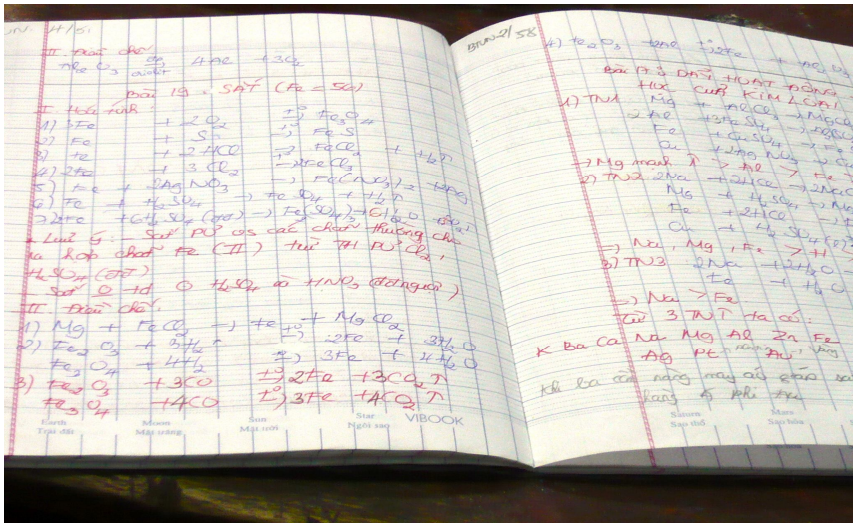
Our experiences handle with experiences we have collected in a short time. These experiences base on:

- lectures, discussions with participants and their questions (compare Attachment 1)

- evaluation of the lectures by participants (compare Attachment 2)

- pilot study about chemical education in Vietnam *(Minh Quang Nguyen)*
- conversations and colloquia with lecturers of the Department of Chemistry of HCMCUP
- exchange with chemistry teachers of private and public schools in Ho Chi Minh City
- interviews and discussions with pupils and students (chemistry lesson)
- hospitiations of chemistry lesson and university events (chemical and pedagogical events)
- accented news about chemical education in Vietnam in public media
- observation in everyday life
- reception of relevant literature (books, magazines)

Scientific Literacy (the German term is **naturwissenschaftliche Bildung**) is rather defined by expert knowledge (static view: convey facts) than by educational processes (dynamic view: convey learning by themselves). Indeed chemistry teaching is mainly subject orientated. It seems that the meaning of chemistry lesson (for students, society and everyday life) hasn't been thematized yet. By concerning this, science of chemistry could be convincingly legitimated by chemistry teaching. The tendency of mathematization (dealing with chemical items) and quantification of chemical processes (stoichiometry) fix the focus on chemical abstraction terms abstracted from sensual experiences.



The **curricula** are overloaded, they widely abstract from life situations, provide learners just a limited orientation guides for later life in terms of awareness of substances, environment orientation, application and transfer of knowledge and evaluation of scientific discoveries and technology.

The **education system** strongly focuses on the aspect of methods and therefore the teaching aspects (compare Attachment 1). Methodical facets of teaching have more priority than pupil behaviour and goals of education. We have recognized this in our lecture so we have renewed our planning for the third lecture: Methodical differentiations effect new strategies of teacher behaviour.

Pupils' behaviour especially in chemistry lesson has been hardly researched in Vietnam. Pupils are the addressees of chemical education. The awareness for this perspective in terms of a system of values increases, also in respect of diagnostic tools to capture pupils' behaviour while teaching (compare Article, Part 2). All participants recognize the contradiction of “pupil orientation” and “overloaded curricula”.

Resources for **experimental** chemistry lesson are provided more and more. While teacher training students get prepared for experiments in chemistry lesson. The extension of experimental and also media-assisted teaching needs more efforts (compare Attachment 1). New learning media are overly positivistic justified. It needs to be regarded that media generally pre-structure teaching in a methodical way. That limits open learning arrangements. This is also inconsistent.

The curriculum for **trainer teaching** allows acquiring differentiated knowledge on a high level. The methodical training focuses on pupils, but only on the effective mediation of subject matter. Chemical education is overly reduced on the chemistry structure. But we see approaches implementing pupil orientation as a topic for teacher training. Surely there is a necessity of didactical innovation for university, e.g new contents like teacher thinking (compare Attachment 2, Point 5). Teacher thinking is an international term.

Chemistry teachers reflect about their daily teaching work and especially the needs of the pupils (compare Attachment 1). Their wishes for conceptional extensions of chemistry lesson don't contradict political educational programs. Teachers show great readiness to communicate with the goal getting new ideas for their own lesson. Less professional are teachers' expectations of getting help for teaching from "outside". Every teacher must construct his or her own lessons. Teacher training should convey this.

3. Our interpretation

Problem situations of chemistry lesson aren't captured clearly. Reasons for that might be that needed terminologies are not differentiated enough and haven't been interrelated yet. Didactical terms abstract from phenomena of lesson and they convey specific imaginations of meaning. That is important for an adequate exchange of arguments in research and teaching.

The support for **pupils** is currently a programmatic and serious claim. And this is an important incentive for the **chemical didactical research** in Vietnam and also for chemistry teacher training. Training always relies on knowledge and research, either an inventory of practice, aiming theorization or a validation of didactical ideas and programs.

Both approaches complement each other. They are basically necessary for model concepts of chemistry lesson. Chemistry didactic as science must try for **prognosis** of chemistry teaching. This task is problematic in a methodical way of research.

Cultural differences influence problem situations of chemistry lessons less than we have thought.

Resonance and openness towards pupil orientation and question concerning education are distinct. There is an awareness of constructive system changes and a great tendency of innovation ideas. The analysis of the evaluation of our lectures also confirms this impression (compare Attachment 2). We expect correlate discussions in the Vietnamese scientific community. In general the Vietnamese are interested in the reality of chemistry lesson in Germany (compare Attachment 1). Of course there is also a problem of theory and practice. This connects.

4. Our perspective

Teaching and research cooperations simplify learning from each other over and above cultural boundaries. An academic exchange also includes chances, searching answers for questions, which we - as German chemistry didactical scientists - have asked in the context of the research field "chemical education in Vietnam". We are especially interested in pupils' characteristics, primarily emotions, interests, attitude and popularity. They influence learning processes and often they are also their result.

There is the intention to empirically research, document and interpret pupil's attitude towards chemistry lesson and therefore indirectly towards chemistry. A

correlate promotion proposal at the University of Paderborn is in process. MA Hoa Dao from Department of Chemistry of HCMC will handle this research in her dissertation.

With such cooperation we hope to get more insights. It helps us to understand research prospects and discoveries about chemical education in Vietnam.

Attachment 1. *Questions of the participants (selection)*

1. Could you describe a chemistry lesson in German classroom? (how is it going? how many pupils in class? what activities pupils do? which methods teachers usually use? how long does it take?...)
2. It is very interesting to know that in Germany curriculum, chemistry lessons are put in the context of everyday life. As you have given us an example, the lesson about substance can be taught in relation with food or beverage drink. Please give us some more examples, and introduce some websites in which we could download the chemistry curriculum in Germany.
3. How do German chemistry teachers assess pupils? By using multiple choice test? oral test? or doing an experiment?
4. How do teachers' assessments affect pupils' learning? Does assessment have decisive meaning to pupils? And do they have much pressure from examination?
5. How does the grade system in Germany? In Vietnam, we use the grade system from 1 to 10. And we don't know if there is any difference between the two systems.
6. Could you please give us one chemistry test of the high school graduate exam?
7. Is pupil orientation a teaching method? Why or why not?
8. Are three recorded audios of Quang related to the topic of the lecture: "Pupil orientation"?
9. What is the purpose of the interview "what is salt?" with three different types of interviewees?
10. What kinds of questions should teachers ask to reflect pupil orientation and to motivate, inspire pupils; and boost their imagination?
11. If you are the teacher of very poor high school without technology (television, computer, projector) and chemistry laboratory, how could you use active teaching method that you have learnt in University?
12. What do you think if one Vietnamese high school would like to invite you to become their teacher?
13. What skill and knowledge do teachers need to equip to use effectively the pupil orientation in their teaching career?
14. In Vietnamese context, there is so much focus on examination, and the learning style is just about memorization. How could we use pupil orientation in such circumstances?

15. In Vietnam, soap is the salt of sodium and fatty acid, detergent is the more complex salt, and washing–up liquid is usually Javen (NaClO) or chlorine water. How about in Germany? What are the compositions of cleaning substances?

16. In Germany, what/how do we use for the purification of everyday source of water?

Attachment 2. *Analyse of the evaluation (N=27)*

EVALUATION FORM

Chemistry teaching in Germany - Theory and Practice

Durchgeführt und ausgewertet von *MA Hoa Dao*

I. Thầy/Cô vui lòng nhận xét một cách tổng quan về Chuyên đề nói trên *(General Assessment)*

(Vui lòng đánh dấu X vào ô được lựa chọn)	**Dưới xa mức mong đợi (rất tệ)** ***Far below your expectation (very bad)***	**Dưới mức mong đợi (tệ)** ***Below your expectation (bad)***	**Như mức mong đợi (tốt)** ***Like your expectation (good)***	**Hơn mức mong đợi (tốt)** ***Beyond your expectation (good)***	**Vượt xa mức mong đợi (rất tốt)** ***Far beyond your expectation (good)***
a. Tính khoa học/logic của Chuyên đề (*is the Course scientific/logic of*)		4%	78%	12%	
b. Tính ứng dụng/thực tiễn của Chuyên đề*(is the Course applicable)*		26%	52%	22%	
c. Phương pháp đào tạo/sư phạm của Giảng viên (Method of Trainer)		11%	63%	22%	4%
d. Trình độ chuyên môn của Giảng viên (Professional ability of Trainer)			44%	37%	19%
e. Khả năng phiên dịch của phiên dịch viên (Interpreter)		(11%: 1.lecture)	85%	15%	

f. Chất lượng phục vụ học viên trong suốt Chuyên đề (Student Service)			70%	30%	
g. Thời lượng Chuyên đề (Time)		22%	74%	4%	
h. Nhận xét tổng quan về Chuyên đề/ Sự hài lòng của Thầy/Cô về Chuyên đề (Satisfaction of students)		8%	81%	11%	

II. Thầy/Cô tự nhận xét về kết quả đào tạo sau khi hoàn tất Chuyên đề này *(Learning outcome – Self assessment)*

	Không đồng ý *(Disagree)*	**Thấp 1 *(Low)***	**2**	**3**	**4**	**Cao 5 *(High)***
i. Hiểu được ý nghĩa của các câu hỏi "Tại sao?", "Để làm gì?" và "Nội dung gì?" trong dạy học Hóa học *(Understanding the meaning of "why", what for" and "what" in teaching Chemistry)*		7%	15%	37%	30%	11%
j. Hiểu được tầm quan trọng của trí tưởng tượng của HS trong dạy học Hóa học *(Understand the importance of pupils' imagination in teaching chemistry)*			11%	33%	41%	15%
k. Hiểu được rằng cần gắn việc dạy học Hóa học với bản thân người học, với xã hội và với môi trường *(Know that chemistry teaching should be relevant with pupils, society and environment)*			7%	11%	44%	38%
l. Hiểu được rằng Định hướng *Dạy học lấy HS làm trung tâm* là một chuỗi các giá trị, chứ không phải là phương pháp dạy học đơn lẻ		4%	11%	7%	37%	41%

(Know that Pupil Orientation is the system of values, not a single method)						
m. Nắm và hiểu được ý nghĩa các phương pháp *Đóng vai* (*Role Playing)* và *Ghép hình (Jigsaw)(Understand the meaning of role playing and Jigsaw method)*			11%	30%	41%	18%
n. Nắm được các điểm mạnh và yếu của Định hướng *Dạy học lấy HS làm trung tâm* và *Dạy học lấy môn học làm trung tâm(Understand the Pros and Cons of Pupil and Subject Orientation)*				37%	41%	22%
o. Nắm được tổng quan tình hình dạy học Hóa học ở Đức *(Know the general situation of Chemistry teaching in Germany)*	4%	4%	15%	29%	41%	7%

III. Chuyên đề này đã mang lại lợi ích gì cho Thầy/Cô? *(What benefits do you receive from the Course)*

- *Role playing and especially Jigsaw methods* (Phương pháp đóng vai và ghép hình, hầu như ai cũng thấy hai phương pháp này hay)
- *Chemistry teaching in the everyday life context* (Dạy học Hóa học gắn với thực tế cuộc sống)
- Imagination (Trí tưởng tượng của học sinh)
- *Pupil orientation (many people see this one useful) and subject orientation* (Dạy học lấy người học làm trung tâm (nhiều học viên thấy hữu ích) và Dạy học lấy môn học làm trung tâm)
- *Learn more about Chemistry teaching situation in Germany* (Hiểu thêm về dạy học Hóa học ở Đức)
- *Look at our-selves and change* (Nhìn lại bản thân và thay đổi)
- *Classroom atmosphere* (Không khí học tập trong lớp)
- *English for chemistry teaching* (Biết tiếng Anh chuyên ngành).

IV. Những nội dung nào trong Chuyên đề này mà Thầy/Cô tâm đắc nhất? *(Which contents in the Course that you like most?)*

- *Role playing and Jigsaw methods* (most of the learners like these ones) (Phương pháp đóng vai và ghép hình, ai cũng thích hai phương pháp này)
- *Chemistry teaching in the everyday life context* (Dạy học hóa học gắn với thực tế cuộc sống)
- *Quang's Interviews on Salt and Tenside* (Phần phỏng vấn của Quang về muối và xà phòng)
- *Imagination* (Trí tượng tượng của học sinh)
- *Open teaching method* (Phương pháp mở)
- *Pupil orientation* (Dạy học lấy học sinh làm trung tâm)
- *"What for"* (Câu hỏi để làm gì?
- *Q and A* (Phần trả lời câu hỏi)
- *Chemistry teaching situation in Germany* (Dạy học Hóa học ở Đức)

V. Theo Thầy/Cô, để khóa học hiệu quả và thú vị hơn, Chuyên đề này cần bổ sung thêm những gì? Vui lòng chia sẻ hai đề xuất để Chuyên đề hoàn thiện hơn.*(To make the Course more effective and interesting, give two suggestions)*

- *First impression is very importance so the first lecture should be good (interpreter)* (ấn tượng ban đầu quan trọng, do đó cần có phiên dịch tốt hơn ngay từ buổi đầu)
- *How to apply these methods in Vietnamese context?* (làm thế nào để áp dụng các phương pháp dạy học hiện đại trong bối cảnh Việt Nam?)
- *Compare German and Vietnamese chemistry teaching* (so sánh dạy học Hóa học ở Đức và Việt Nam)
- *More videos, more pictures about chemistry teaching in Germany* (cần nhiều video, hình ảnh về dạy học Hóa học ở Đức)
- *More time for the lecture, more time for discussion* (cần nhiều thời gian hơn cho các chuyên đề, nhiều thời gian thảo luận hơn)
- *More information about the chemistry teaching in Germany (assessment, lessons, methods, concrete examples of methods, experiment lessons, the position of chemistry subject in Germany… we want more)* (cần nhiều thông tin hơn về dạy học Hóa học ở Đức (cách đánh giá, bài học, phương pháp, ví dụ cụ thể về pp, giờ thực hành, vị trí của dạy học Hóa học ở Đức…)
- *Discussion should be obliged* (phần thảo luận nên bắt buộc)
- *Vietnamese version of lecture should be better*(bản dịch tiếng Việt cần tốt hơn nữa)

- *We cannot understand all of the lecture because of the language barrier so that Vietnamese experts should summarize the ideas* (nên có chuyên gia Việt tóm tắt lại, vì không hiểu hết bài học do rào cản ngôn ngữ)
- *The lecture should be on time (usually late in 10-15 mins)* (các bài giảng nên đúng giờ vì hay trễ 10-15 phút).

VI. Thầy/Cô đã làm gì và/hay dự định làm gì sau Chuyên đề này? Xin vui lòng nêu rõ. *(What are you going to do after the Course?)*

- *Pay attention to pupils imagination* (chú ý đến trí tưởng tượng của học sinh)
- *Connect lessons to everyday life* (kết nối bài học với thực tế cuộc sống)
- *Apply Role playing and Jigsaw methods into teaching* (áp dụng phương pháp Đóng vai và Ghép hình)
- *Focus on Pupil orientation* (Quan tâm hơn đến cách dạy học hướng về học sinh)

VII. Thầy/Cô có dự định giới thiệu Chuyên đề này đến nhiều người không? (Will you share information you learn from this Course with your colleagues?/introduce the Course to other peoples?)

- 89%: *absolutely yes* (chắc chắn sẽ giới thiệu)
- 7%: *yes if the Course has an improvement about the application in VN* (có nếu được cải thiện hay có ích hơn)
- 4%: *no* (không).

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