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GUIDELINES FOR CHEMISTRY TEACHER STUDENTS – METHODOLOGICAL SCAFFOLDING FOR A PUPIL–ORIENTATED CONTEXT

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ABSTRACT

The comprehension of scaffolding (vn: bước đệm gợi ý) is to supply mental concepts for themed learning processes constructed by terms and detailed specifications. In the Master Seminar "Some issues of Didactics in Chemistry (Class: Master course Theory and Methodology of teaching Chemistry)" the students could follow certain a structured survey concerning pupil orientated chemistry teaching. A consistent behavior of chemistry teachers was focused simultaneously (compare attachment "handout").

Keywords: pupil-orientated Chemistry teaching, teacher behavior, learning psychology, scaffolding, higher education.

TÓM TẮT

Các hướng dẫn cho sinh viên sư phạm Hóa học
– Các bước đệm gợi ý về mặt phương pháp luận cho bối cảnh học tập hướng đến người học

Sự hiểu biết về bước đệm gợi ý nhằm cung cấp các khái niệm tư duy cho các quá trình học tập theo chủ đề được xây dựng bởi các thuật ngữ và các mô tả chi tiết. Trong môn học ở bậc Thạc sĩ "Một số vấn đề về lí luận và phương pháp dạy học Hóa học (Từ khóa học Thạc sĩ lí luận và phương pháp dạy học Hóa học)" sinh viên có thể theo dõi một khảo sát theo cấu trúc nhất định liên quan đến dạy học Hóa học hướng đến người học. Các biểu hiện nhất quán của giáo viên Hóa học cũng đồng thời được chú trọng (so sánh file đính kèm "tờ rơi").

Từ khóa: dạy học Hóa học hướng đến người học, hành vi của giáo viên, tâm lí dạy học, bước đệm gợi ý, giáo dục bậc cao.

1. Knowledge in Chemical Methodology – Basic for pupil-orientated learning Processes

Generally and first of all methodological knowledge affects landmarks for the learning activities of the students. This knowledge is conveyed in an orderly structure and

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in complex relationships. In chemistry teaching lessons it must be respected, therefore mental activated and by teaching utilized. At least didactical knowledge possesses action and analysis functions. Scaffolding-measures concretize successful learning and psychological basics related to the constructivist learning theory. Fundamentally they are valid for learning activities of students studying Chemistry Methodology respectively Chemistry didactic.

In a global sight it has highlighted that application or/and implementation of scientific findings are neglected in the teaching practice although it is essential. Firstly and foremost the pedagogical fields and the classroom situation is very indefinite and situated. Both fields are determined by individual conditions of pupils and teachers and also by education laws – not less one (National Assembly of Vietnam, 2005; Central Committee of the Communist Party of Vietnam, 2013).

Modeling and forecasts of chemistry teaching processes are realizable but mostly or often inaccurate. Apparent the general daily teaching practice and in special every single classroom situation evades generalizing scientifically considerations. The theory formation will succeed to some extent – perhaps. On the other hand methodological guidelines are determined in advance by experts and by education authorities as normative directions concerning teaching actions. Such methodological demands or standards are different considerable influenced by cultural attitudes and insights (Becker, H.- J. & Nguyen, M.Q., 2013).

Also the impact of the subject "chemistry" is remarkable relating to conceptions of Chemical Education and decisions for planning of chemistry teaching lessons. This meaning will fix with the terms "subject-orientated" chemistry education. This methodological approach generates and produces teaching structures and methods analog to the structure of discipline "chemistry". It neglects that structures of the discipline "chemistry" are no complete model of the teaching process and that the "structure of discipline" don't comply with pupil's learning structure. Only, they stipulate the sequence in fixed steps, phases and so on depending on the time and planning the teaching lesson in temporal sequences. Therefore, Chemistry teaching is required and thus restricted. The evidence of such so called articulation schemes is not verified seriously. Occasionally is investigated how these methodological structures influences the acquisition of chemical knowledge.

These problems must be reflected from the teacher training – in general. In this relation it is necessary to convey the master students different and detailed landmarks for

"more" pupil-orientated lessons. This conception of Higher Education approximates more the reality of teaching than the stringent subject-orientated "way". The students expand and strengthen their methodological knowledge and their teaching will be more variable and flexible when they are professional teachers. The interest and the abilities of pupils take into account in a substantial manner.

2. Pupil-Orientation – a reliable Principle in constructivist Meaning and Importance

Reality and entitlement of Methodology aim at the efficiency of the learners more than at their individual attitudes and needs. Nevertheless the methodological course schemes of chemistry teaching consider or rather associate knowledge for learning operations in general often generated in learning labs outside of classroom situations or conditions. Psychological insights concerning learning processes are theorized in a behaviorist, cognitive and constructivist point of view.

Also, for a "good" chemistry teacher *(compare attachment)* it is difficult and complicated to design individual processes of learning in a constructivist perspective: Learning individuals, therefore pupils and students construct their learning processes in different manner, thus also knowledge and knowledge growth. Pupil-orientated chemistry lessons satisfy these constructivist claims. A "natural" view for teaching the subject "chemistry" means to take into account the behavior of pupils. In opposite, subject-orientated lessons are normative directions of the scientific community as an imagination of a preferable chemistry teaching, so to speak as a program, no model of chemistry teaching.

Teacher training must utilize chances and carry out its mission and assignment to support the learning and understanding of pupil-orientation due to scaffolding guidelines. So it is possible to make the students aware of pupil-orientated thinking, suggestions, principles, rules and decisions. This approach can renewal Chemical Education and provide worldwide- phrased targets to solve problematical situations of chemistry teacher behavior. The caricature illustrates the awareness of a subject-orientated chemistry teacher ***overdrawing*** in ironical portrayal (compare figure).

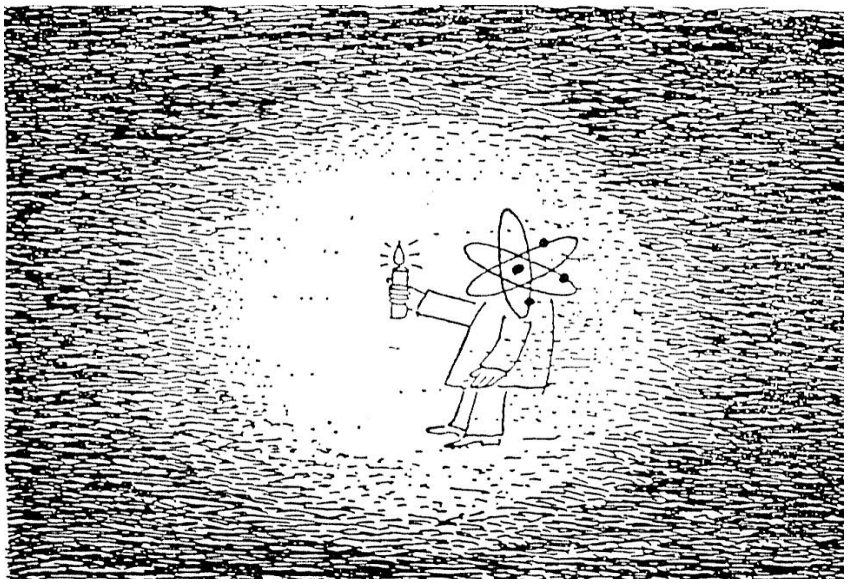

Figure. *A chemistry teacher blindfolded looking for the pupils,* ***overdrawing*** *in ironical portrayal*

3. The Seminar "Some issues of Didactics in Chemistry" - Scaffolding Landmarks for Master Students

Organisation, Conception, Conditions

The seminar was organized as a bilingual project in November/December 2017 with overall 36 hours. 26 Students take a part actively in these lessons. The seminar's language was English, occasionally alternating with Vietnamese. Group tuitions were encouraged. A seminar reader (Becker, H. - J. & Nguyen, M.Q., 2017) was supplied as accompanied materials for self-study.

In the core and in accordance with the master students the seminar is targeted at

- in general to expose scientifically landmarks for learning processes in chemistry teaching
- in particular to convey pupil-orientated possibilities and to demonstrate in the higher education context
- preferable to realize in the own teaching practice to some extent.

All methodological considerations of the students base on the Vietnamese situation concerning the policy of Chemical Education, the Chemistry Curriculum and the planned improvements. Generally these decisions and in special the planning of pupil-orientation was presented and justified from every working group of the students. It was discussed in the plenary a little bit hesitantly but seriously. The exchange of ideas was following the content of the speech. The master students dispose on extensive experiences in chemistry

teaching, this is a good condition for reflections concerning the mutual dependences of methodological theory and practice. The bilingual seminar situation, thus the teaching in English, was very helpful: Relevant terms and components of learning connections must be handled carefully and deepened in a mental way.

Teaching and Learning Seminare Methods as an Overview

The subjects Methodology in general and pupil-orientated in special need a higher education didactic perspective. It is necessary to illustrate and demonstrate the conception pupil-orientation about the seminar. The best way is to practizise this principle in a student-orientated sense and to boost individual learning possibilities of the students. Then the teacher training will fulfill their own standards which are demanded from teachers and students in the teaching process. Thereby teacher training becomes honestly, trustful and convincing.

The higher education planning of the seminar is characterized by openness and situativity. These principles are demanding for the teaching personnel. In detail was realized

- To respect and to observe the awareness and imaginations of the master students
- To respond to behavior and thinking of the students
- To deepen and to boost the interests of the students as an emotional intention
- To take seriously learning and understanding problems of the students
- To realize proposals and suggestions of the students
- To focus the different substantial learning environment and surrounding in a chemical perspective
- To compare Vietnamese and German standards concerning teaching chemistry
- To structure and to fix important learning results in different matters and
- To point to the reader of the seminar as scaffolding landmark for the students.

These mental principles were supported through habitual methods and usual media technology realized in the normal higher education climate. In total it is clarified that all activities of the seminar are focused on the handout (*compare chapter 4*).

4. Handout "Pupil-Orientation – Possibilities" (compare Attachment)

The handout is an action plan teaching pupil-orientated. This flyer concentrates some appropriate possibilities in retrospect - also practized in the lectures. It is learning and working aid together conceived as a orientation framework for theoretical insights and consequences for practical situations. The flyer was handed over the master students before they had to prepare the requested teaching project.

The structured and systematical representations don't contradict the situational entitlement of pupil-orientated impulses to teach chemistry in this way. The compilation is able to teach to and to demonstrate learning psychological findings. This gained knowledge can be transferred in practical teaching possibilities. In a conceptual and abstract view the handout supports self-learning of the master students, for instance as scaffolding-landmarks for own problem solving learning processes. More ever, the handout is a focal point for the elaborations of the master students which visited the seminar. The handout is described originally.

At first, the handout outlines skills for chemistry teachers shaping pupil-orientated conception for chemistry teaching. Expressly and impliedly it is building a scaffold to realize pupil-orientated behavior, and it is sketching the profile of a "good" chemistry teacher (Becker, H.-J. & Nguyen, M.Q., 2014). These explanations will supplement by pupil-orientated possibilities in general and especially in best practice orientations *(compare handout)*. Performing such suggestions the results of learning processes of the pupils will grow probably. Pupil-orientated conceptions focus more applications for chemical knowledge than subject-orientated methods of chemistry teaching.

Afterwards, theoretical impulses are concretized through descriptions and specifications of elementary teaching acts. This transfer-process is very effective for the learning of chemistry methodology *(compare handout)*. These recommendations illustrate master students principles and examples to teach situated.

Last, an open question can motivate the students to reflect their own teaching behavior *(compare handout)*. Simultaneously this question can students help to make sure their self: The pupil-orientated content of the seminar can be reflected on the base of their academic educational biography and their practical experiences in teaching. This is a great chance for the higher educational approach that students can follow up with conceptions and contents of teacher training in a critical and self-critical manner (Doan, V.D. 2017; Phan, D.C.T. & Nguyen, T.N., 2017; Trinh, L.H.P., 2017). When the students handle this question seriously than the question becomes a sustainable impulse to develop the mental performance.

The extensive seminar reader (Becker, H.-J. & Nguyen, M.Q., 2017) offers the students literature published in English, Vietnamese and German Journals and concerning the conception pupil orientation. Inasmuch this reader possesses a scaffolding function appropriated to learn by studying on one's own. The content of the reader focuses the principle "pupil - orientation" as a trend for chemistry teaching. The Vietnamese scientific community discusses and reflects too to activate and motivate the pupils more self-

employed and self-acting (Nguyen, H.G., 2014; Dao, T.H.H., 2012, 2014; Becker, H.-J. & Nguyen, M.Q., 2015; Becker, H.-J. & Nguyen, M.Q., 2017). The teacher *training* must *train* the message "*pupil orientation*": So students cement awareness of it (Doan, V.D., 2017; Phan, D.C.T & Nguyen, T.N., 2017; Trinh, L.H.P., 2017).

5. Learning Processes of Students - a small Outlook

Initially the students must be capable of adapting, applying and doing some aspects of methods in a pupil - orientation matter. This autonomy is a condition to remove their self from the scaffolding materials "step by step". Simultaneously the students can promote an awareness of the methodological principle "pupil orientation". This awareness is a condition for implementing of pupil orientated rules and principles in their own teaching activities in the future.

In the next time it will be investigated how far the master students have learned the principle pupil orientation. For this purpose it will be constituted in a qualitative sight how elements, parts, aspects and moments of pupil orientation are mirrored and reflected in work results of the master students, such as papers, speeches, handouts, written elaborations, produced videos, power-point-presentations, recorded seminar processes, student statements and comments, situated and planned panel paintings, role playing, experimental arrangements, daily life applications and others.

The master student's learning effects could be evaluated in different directions measured by the targets of the master course. Above it will be reported in a following article in this Journal of Science (Becker, H.-J. & Vietnamese Master-Students 2018): The teacher expertise or the teacher competence "pupil orientation" is the basic of professional teacher behavior – in addition to solid and strong chemical knowledge. The task and the challenge for the Chemistry Methodology is to combine both aspects for the teaching process. The research in this direction must proceed in the future – urgently.

Attachment (in the original)

Handout „Pupil orientation" - Possibilities *(compare Do et al 2017)*

A pupil orientated chemistry teacher *(compare Article Becker/Nguyen, 54/2014)*

- is flexible, situated versatile, trustful
- focuses **pupil activities** (operations, cognition) and pupil attitudes (interests, popularity)
- boosts **learning processes** of the pupils
- plans, reflects, concretizes, situates, evaluates **learning processes**

- take up **spontaneous interests** by teaching and considers the **subject interests** of the pupils
- enables great **autonomy**, **self- experiencing, social Integration**
- respects **various relevance levels** of Chemical Education
- concretize **daily life conceptions** using **substances, activities, imaginations, applications**
- considers **daily life imaginations about chemistry** (terms, theories, models, explanations and so on)
- knows **about learning model** concerning the **development of mental thinking** in connection to the age of the pupils.

Learning Impulses in a theoretical sight for chemistry teaching are *(compare articles Becker/Nguyen 62/2014, Becker and Lehmann 1997, compare copied articles of Vietnamese authors in reader).*

In general

- the understanding of **pupils imaginations** of chemical terms, phenomena, thinking in a **constructive learning** perspective
- **Extraction** of previous knowledge
- **Boosting Emotions** (popularity, interests, attitudes, affects and so on).

In special

- Helping pupils **construct** and **reconstruct knowledge**
- Finding **problems** and **solutions** together with pupils
- Recognizing the meaning of chemical terms as **learning difficulties**
- Finding **playing impulses**
- Making aware of **cognitive conflicts** between **scientific** explanations and **everyday life** interpretations
- Illustrating and verbalizing phenomena, notice, observation, interpretation
- Contrasting **(daily life)** experience with **(chemistry)** experiment as methods of awareness
- Especially noticing experiments as **targeted observing**
- Using **everyday life communication** as **situated** motive

- Involving **out-of-school learning environments**
- Using differentiated **competence** and **relevance** levels
- Using of so called **mapping instruments** as a mind- and/or concept map
- Integrate **different natural science subjects** *(compare Becker, Dao, Nguyen 2015).*

Learning Impulses in a practical sight for chemistry teaching are

- Implying and analyzing **product information**
- Problematizing **commercial** concerning products
- Using **public media** in order to get an access to chemical problems
- Differentiate **everyday life terms**
- Illustrating chemical everyday life terms by **experiments with everyday life substances**
- Creative (non dangerous) **handling with substances**
- Planning and executing **simple pupil experiments**
- Using **everyday life instruments** and **operations** for nature science
- Transforming **everyday life experiences into experiments**
- Allowing **instrumental constructs by pupils**
- Developing **scientific explanations of everyday life experiences**
- Extract **imaginations of the pupils** through daily life materials and daily life activities***and.***

Reflect your experiences of your longtime teaching: Can you remember on teaching situations in which you had a pupil-orientated view? *(Compare Do et al 2018).*

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