BASIC THOUGHTS CONCERNING TEACHING RESEARCH – SITUATION, PERSPECTIVES AND LIMITS

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ABSTRACT

All scientific disciplines have a research objective and a research methodology. Research objects of chemistry didactics are chemistry teaching and especially chemical education. We discuss the question, how to describe or to image (as model), to explain or to interpret (as theory) and to predetermine or to predict (as prognosis) "chemical education processes", within teaching and education practice in its complexity.. The article based on the manuscript of a lecture that we have held at the chemistry department of Hanoi National University of Education. Our impressions concerning the lecture we have compiled in the last chapter.

Keywords: education research, teaching research, chemistry didactical research, empirical studies.

TÓM TẮT

Một số ý tưởng cơ bản về nghiên cứu trong dạy học – tình hình, quan điểm và giới hạn nghiên cứu

Tất cả các lĩnh vực khoa học đều có mục tiêu nghiên cứu và phương pháp nghiên cứu. Các mục tiêu nghiên cứu của lí luận và phương pháp dạy học Hóa học là dạy học Hóa học và đặc biệt là giáo dục Hóa học. Chúng tôi thảo luận vấn đề sau: làm sao để mô tả hoặc tưởng tượng (mô hình), để giải thích hoặc lí giải (lí thuyết) và để định trước hay dự đoán (dự báo) "các quá trình giáo dục Hóa học", trong quá trình dạy học và giáo dục vốn phức tạp. Bài báo này dựa trên bản thảo của bài giảng của chúng tôi được tiến hành tại Khoa Hóa học, Đại học Sư phạm Hà Nội. Ấn tượng của chúng tôi liên quan đến bài giảng này được trình bày trong chương cuối.

Từ khóa: giáo dục Hóa học, nghiên cứu dạy học, nghiên cứu Lí luận và phương pháp dạy học Hóa học, nghiên cứu thực nghiệm.

1. Preamble –Meta theory of our research perspectives

This Article focuses the research aspects, the research situations of our discipline chemistry didactics in special and education and teaching research in general. Base of this article is the manuscript of a lecture on 17.9.15 at the chemistry department, methodology of the Hanoi National University of Education. We have added a

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summary that contains our impression of our lecture with chemistry methodologist, Master-students, PhD-students and also chemists as audience. This lecture focuses basic thoughts - from our perspective. Our overview is perhaps a little bit too theoretical while we concentrate on important basic aspects. Therefore we think it is a constructive lecture. We must know discussing, reflecting the problems and chances of our research methods. Then the assessment of our research activities will be successful. We have a chance to change practice of teaching and create new ways of it. In Germany we have been discuss possibilities to research for a long time.

Prof. Dr. Becker has been a researcher of the discipline didactics of chemistry for a long time and he has been a lecturer for students and also a teacher for pupils with different ages. He has got a constructive insight look in theory as well as in practice. He tries to combine both parts of the same "medal". He has started some own research projects and he has lectured for 40 years at the university. He taught for 17 years the subject chemistry (and also mathematics) at schools and for a long time he was was "lecturer" and "teacher" at the same time.

Our article "Basic thoughts concerning teaching research – situation, perspectives and limits" is structured in seven topics. We focussed the situation in Germany based on my article "Trendbericht Chemiedidaktik 2012" (*In English: Trend report chemistry didactics 2012*).This article described the research situation in Germany, in special of empirical research.

2. Teaching Research – socially determined

Researches concerning Teaching/Education must consider social basics/backgrounds. As general outline they determine the frame of the researcher! This also applies to Didactics.

From my perspective:

- Researches can just terminally approach to the reality of teaching /education.
- Deduced handling recommendations are problematic and not suitable for every situation.
- Research processes serve different ideological intentions.
- It doesn't matter if the way and kind of researching and the usage of logical statistical methods are correct, in the sense of mathematics, theory of science and theory of knowledge.
- The international trend to implement research results - generated in other cultural context – should be seen as impulses that need to be tested in a critical way.

3. Object of researches – Between Determination and Situativity

Teaching/Education is a complex of factors. That is basic knowledge: Too much variables with differentiated specifications effect mutually and in combination on the process of action. Also scientific research planning only considers "wished" variables of the researcher, in order to teach. It is impossible for the researcher to eliminate

effects of non-considered variables. Didactics is therefore just a raw grid for teaching action. The totality of teaching action is unseizable. The question is if teaching could ever be modelled.

- Researches are reduced to few variables that are "constitutive".
- They are always limited to the "ideology of the researcher", that means imagination, assumptions, goals of the researcher
- It cannot be excluded that latent, non-considered variables have an influence: They are often unnoticed.
- Researches concerning chemical education are not objective, because the item "chemical education" will always be interpretable

4. Necessity of research – An Approach to Reality

Nonetheless researches are necessary, in order to fix knowledge concerning the issue "teaching /education":

- They are performed as social duty.
- They are claim and task of any scientific effort.
- They are a base for communication between experts.
- They convey "new" perspectives.
- They abstract from the phenomena "teaching".
- They create new understandings in form of terms (meanings) and modelling.
- They focus single knowledge to constructions of variables.
- They are basic for prospects and predictions.
- They create a network of relations as a continuing approach to reality, also by "re-verifications".
- They control developments in teaching reality.

5. Processes – The Relation between "Theory" and "Practice"

In this sense research processes are complex. The theory-practice-relation in the context of teaching/education research is disordered or one-sided: Teaching/education practice is not always starting point of "theorizing" reflections. If they do so they are often just selective in contexts which researcher and society are interested in. Often teaching research is proceeded in laboratory and therefore not in the complex field "teaching". Interfering variables don't exist, this is a clinical situation. Transferability of research results into teaching is therefore problematic: Teachers criticize that new findings can't be applied in teaching practice. Insights of teaching/education which base on genius ideas of the researcher and which depend on meta-theory of the researcher are even more problematic than research in laboratory. By this critique it is important to consider in how far recommendations of action will be implemented in practice by teachers. In this case meta-theories of teachers must be questioned.

It is still true that results of research processes must be critically verified in reality before they are set as basic knowledge and before they are implemented into teaching.

Such knowledge and findings of practice would effect on the theory. Theory must be "re-thought" and than apply into practice again. Such a kind of research is complicated and hard to realize. But didactical research must always connect theory with practice and practice with theory.

From my perspective "practice" has a high significance, because it challenges the "theory" to find solutions: Therefore practitioner, that means practicing teachers, must be involved in research. In addition they are also a source of insights. They always must prognosticate their teaching by planning and they must link back teaching happenings to their planning in order to prepare the next planning.

6. Teacher – Receiver of Research and Researcher at the same time

Teaching research is always aiming at recommendations for action. These recommendations must be concluded from research results. From my perspective this is the central task of didactics: Such a "rational" behaviour corresponds to aspects of professionalizing claims. All somehow deduced "instructions" are important for teachers. All together they are a wide repertoire of actions – for an infinite diversity in teaching situations. In addition they provide chances for teachers in order to get a feedback on their needs and their personality by reflections.

Many of the mentioned Problems could be avoid if teachers would be involved in research processes more. Research ideas could be relativized from beginning. Action research has tried this in the past.

In addition: Teacher training has the duty to train self confident teachers for research duties. Academic teacher behaviour is determined by teaching science. In this meaning is teaching behaviour a professional behaviour. Such teacher awareness would effect an efficient and interest boosting teaching. Because the creation of daily teaching is always a research act: Teachers must make versatile decisions and evaluate their effect. Therefore teachers can modify and optimize their teaching models. Researchers in contrast have no chance getting direct access to practical teaching.

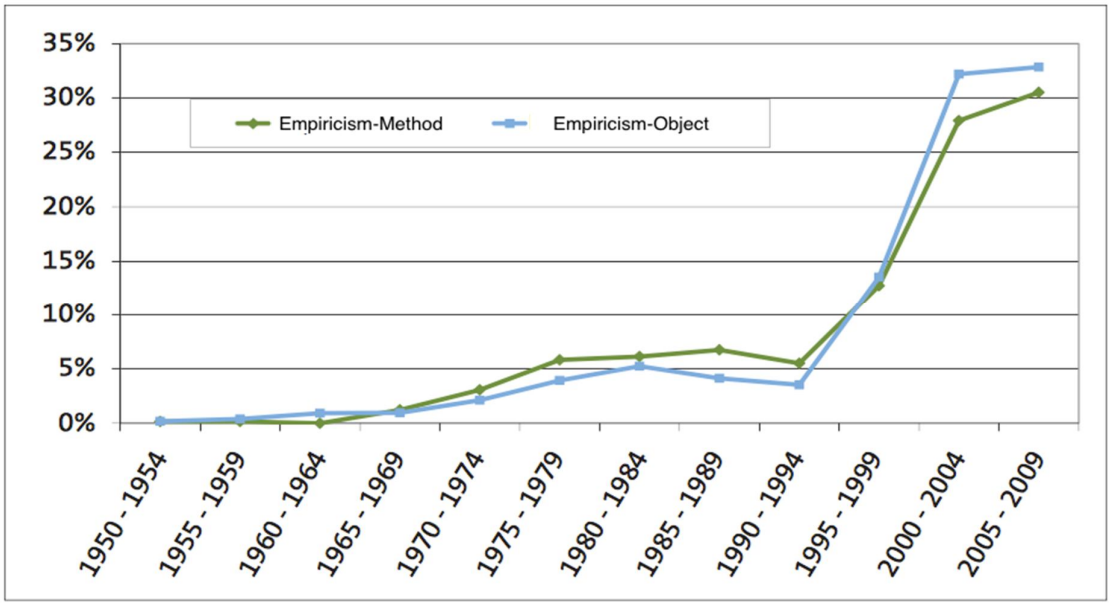
7. German Situation – Trend report in Chemistry Didactics

We try to mark the current German situation by some statistical data. The base of this is the "Trendbericht Chemiedidaktik 2012"(*Trend Report Didactics of Chemistry*), published by H.-J. Becker et. al. in Journal Nachrichten aus der Chemie (*News out of the chemistry*) 2013 book 3. Because of the lack of time we just want to give you some basic remarks.

- In general we highlight the empirical orientated teaching researches, that are more preferred in Germany than
- hermeneutic
- heuristic and
- ideology critical

approaches. I'm convinced that all knowledge approaches depend on each other. The qualitative empirical research has shown, that only empirical facts must be reflected in a hermeneutic, heuristic and ideology critical way. This is a problem for the researcher. Researches in Germany are always control and knowledge generating instruments at the same time.

The first graphic (Abb.1) shows that research processes themselves are reflected in Germany. Many aspects - we have discussed in a critical way above - are discussed constructively in the scientific community. But of course most of the research publications consider at first the research object.



Graphic 1. *Publications with empirical emphasis in the period 1950 until 2009; green graph: Empiricism-Method, N=652; blue graph: Empiricism-Object, N=4093. (based on our database FADOK, status as of 01.11.2012)*

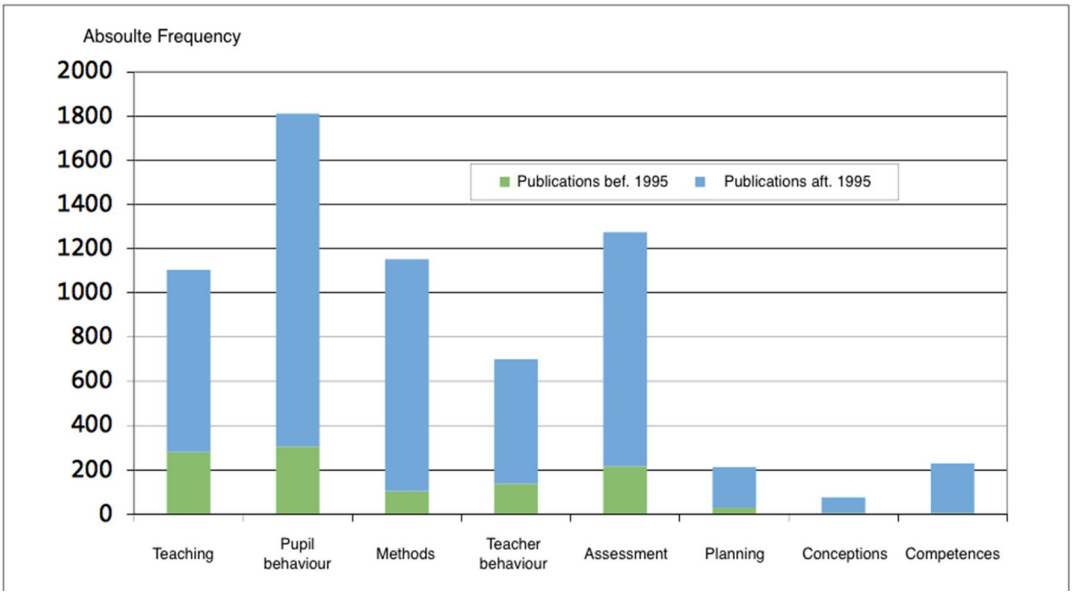
The amount of occupation with research contexts has been increased late (starting 1965). In this time (until 1974) a lot of professions in Chemistry didactics have been established in Germany. The rapid upswing (from 1990-1994) is caused by the belief that only empirical teaching research can improve current teaching situation. But this one-sided positivistic perspective hasn't caused a change yet. Perhaps because of the complexity "teaching".

The second graphic (Abb.2) shows key aspects of chemistry didactical research concerning the period before and after 1995. We can say in conclusion that empirical research after 1995 has researched basic parameters like pupil behaviour, methods and teaching aspects. A special key aspect is the studies concerning teacher behaviour.

Behaviour of teachers has been empirically researched, in the sense of secondary research. For this the pedagogical-knowledge-content test has been used as instrument.

The increased amount of empirical assessment studies mirrors the high amount of publications concerning pupil behaviour. The current trend is to verify the model based competence qualification of learners. Suitable instruments for this with diagnostic character are in development.

The low amount of studies concerning planning - the main duty of didactics – surprises. Publications concerning planning and teaching accent first of all teaching content, and no modelling and prognosticating facets.



Graphic 2. *Thematic key aspects of empirical publications before and after 1995. (Based on our database FADOK, status as of 01.11.2012; N_{Total}=6559; $N_{1950-1994}$=1081; $N_{1995-2012}$=5478; Multiple attribution)*

Last but not least we want to remark the following. A rational chemistry didactical research must always consider or tie on already existing chemistry didactical research efforts. This would be positive in a knowledge critical and research economical way.

There are a lot of expectations on research – especially in Germany. But it needs to be considered that complex and differentiated research does not effect automatically an improving of the educational situation.

But experts are working on it.

8. Discussions – Our impressions of the lecture at Hanoi National University of Education

Our points of view concerning chemistry didactical research have been unfamiliar for the participants at first. Most of the participants couldn't get used to our perspective that teaching research can't never in the entireness be objective. Some participants have asked critical and continuing questions that we have picked up and deepen. In this discussion the issue of validity of research have been debated intensively - additionally.

Our point that education and teaching research are determined by social political decisions – all over the world - and of course by the meta theories of the researcher was the starting point of intense discussions. It seems that most of the participants wasn't aware of this frame conditions.

From our perspective it is impossible to entirely and comprehensively describe, plan or predict different processes. Because of the complexity of the variables. The participants agreed with this. They have seen that the way scientists are used to research is just as a periodic, mostly fixed sequence of methodical steps as "base planning".

The idea of integrating teachers in research was welcomed. The awareness of researching of the teacher still needs to be developed. For most of the participants this idea was very valuable for the chemistry didactics. Planning teaching, formulating teaching goals, regarding conditions of pupils are actually "researching processes" concerning goal prognoses. The participants have seen that it is difficult: In this situation teachers are actors (and therefore an important variable) and researcher at the same time. The teacher must "act" while he is observing the whole teaching situation.

The perspective of participating chemists was interesting. The perspective of parallelising the processes of modelling and prognosis of teaching processes with chemical knowledge finding acts. That has boosted the discussions and the understandings for our approach. The participants have seen that the registration of all objectivations for teaching is difficult.

Goal of educational research is to reduce the complexity of the phenomena "teaching" by knowledge processes. For this suitable terms need to be deflected from the phenomena. Such terms have specific meaning prospects and they are tools for further research, e.g. for further development of teaching curricula. The Participants have discussed about the complex abstraction efforts, while they have seen the necessity of a closer connection between theory and practice.

We have the impression that the participants had a clear and simple model prospect of teaching. Teaching models focus in first sight learning contents that also fix the methods. These perspectives neglect other variables that are meaningful for teaching processes, especially pupil behaviour. The more variables a model considers the more it approaches objectivity or the real teaching practice. Most of the participants

had a phenomenological perspective on teaching therefore an awareness of the participants for suitable abstract terms has not been distinctive.

An example of how an empirical study handles with theoretical constructs and terms has been demonstrated by the follow up presentation of Dao Thi Hoang Hoa of the Chemistry Department UE HCMC. She has discussed basic thoughts of her PhD dissertation "Pupil attitudes concerning chemistry teaching". In particular she has presented her research methodical perspective. Most of the participants have seen that her research is constitutive for the Vietnamese methodology, because she focuses on attitudes of pupils concerning chemistry teaching in emotional characteristics. Therefore the learner is definitely fixed as a variable in the teaching model. Furthermore the presentation of Hoa illustrated the measurability of variables (scaling of variables, scale levels, mathematical handling) and the necessity of suitable interpretation of the empirical data. Therefore we could relativize the critique of the participants that we have shown less examples.

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Notes to the literature:

We refer to the very extensive list of literature of the contribution of H.-J. Becker and others, *Trendbericht "Chemiedidaktik 2012"* (In: Nachrichten der Chemie, 2013, 61, p.359), which is available online:

www.gdch.de/publikationen/nachrichten-aus-der-chemie/downloads/literaturlisten/trendberichte.html

The list mainly includes German as well as English-speaking literature. It considers the period of 1950 - 2014. Please note that the relevant literature aspects of chemistry teaching research are always linked with a special research topic. Only a few contributions have an exclusively epistemological and critical perspective.

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