

A Good Instruction in Mathematics Education should be Open but Structured

Olga Graumann, Prof. Dr. Dr. h.c.
Retired Professor of Education
Institute of Education, University of Hildesheim
Marienburger Platz 22, D-31141 Hildesheim, Germany
jaugrau@uni-hildesheim.de

That we have to change the teaching method away from the traditional cramming school was demanded already about hundred years ago and is uncontested in pedagogy today. But the reality in school often is different from the theory. Even though the conception “Self Directed Learning” / “Independend Study” / “Minimally Invasive Education” (Offener Unterricht) is practiced a lot in primary school in Germany the pedagogical cardinal points are not understood by many of the teachers; they often think one can let work the pupils by themselves without those instructions the pupils need to become successful.

Self Directed Learning is amongst others characterized by free work, week-plan, project work and differentiating teaching. These teaching methods trace back to conceptions of reform pedagogy arising from different theories in different times and different countries (cf. e.g. Montessori, Petersen, Dewey, Kilpatrick). Therefore Self Directed Learning is defined by an assortment of several elements of different theories. Thus one runs the risk to lose sight of the theoretical background which can lead to a frivolous simplification and non-reflected acting.

Some critical remarks about a reduced setting of open instruction are the following:

- One assumes in respect to Self Directed Learning that children of today need more possibilities of own decisions and more free space for self-activity and creativity. But do become children more autonomous if they get the choice to take one working sheet or another one? And don't have children of today already too much stress of decisions in their every day life so that it would be better to relieve them from nonsensical stress in school?
- The change from commanding style to bargaining style in household escalates today and also captures school. Many children already start with bargaining instead of looking at the task. This keeps energies away from struggling with the objects. Shall we strengthen this trend?
- Self Directed Learning can mislead a teacher to relieve him/her from handling and responsibility in course processing. In this situation children can feel left alone which may underline their experiences from at home.
- In underprivileged families and families with migration background the bargain style often is not infiltrated in household. Most decisions there will be made by the parents or the personal living condition. Children of such families will get problems with open instruction if they do not get help from the teacher or a classmate.
- Children of underprivileged families and families with migration background as well as children with mental handicaps often do not have the ability for motivation and creativity. Can we see here the limitation of Self Directed Learning?

Another question is: How shall we react on the existing contradictions, which are caused besides others from the ascending demands by the big heterogeneity of the learning groups and the achievements ask from society with parallel necessity of differentiated and individual learning. To make plain this I first will paint a situation as example.

***Jonas** is in grade 3 of a primary school. He has two sisters and lives in a one family house. His father is a technician and his mother is a teacher. He has an own Computer. When starting school he already could read and count until thousand.*

***Simon** in the same class. He has several brothers and sisters and lives in a flat of a high-rise building. His father and mother both go for working so that the children on the afternoon are mostly by themselves. Simon has interest for general science.*

*After Christmas holydays the children of this class first discuss their experience during their holydays. **Jonas** was skiing with his father. **Simon** did not have any special adventures. On Christmas Eve his parents did have a struggle with each other.*

In the second part of this lesson the children get two different work sheets about symmetry – the subject they did deal with before Christmas holyday. They can decide by themselves with which one they will start. One sheet bears reference to a Christmas tree. The children shall put different figures- they can decide by themselves - on the tree so that the tree is symmetric still.

In the third part of this lesson the children get a working sheet with tasks for a week-plan covering exercises of arithmetic, an essay about holiday adventures and a plan to find different connections for an electric circuit. In the classroom there is a corner the children can go to read something or to make experiences with material like electric circuits.

This described situation in school has a conceptual design of an Self Directed Learning. But you may imagine that Simon and Jonas can learn in this situation less and more.

School cannot afford to have so much idle time as in the example described above. What did **Simon** learn in this lesson? The working sheet with the Christmas tree for him is reminiscent of the bad situation at home on Christmas Eve so that he did not find figures to put at the tree. With the arithmetic tasks on the week-plan he did have had problems already before Christmas. Because there was nobody in the class to help him it again came out that he is not able to overcome given tasks. The essay also was nothing for his situation. And the electric circuit he already knew before.

And what did **Jonas** learn in this lesson? The given tasks he could carry out very fast because they did include nothing new for him. He was used to do arts and handicrafts at home. And about his adventures on Christmas holydays he reported on his classmate in the talking circle in the morning. So he did overcome the time somehow or other but did not learn anything new.

Self Directed Learning runs the risk to degenerate to a mere actionism if not each step, each task is prepared for different previous knowledge as well as different situations of life of the children.

In a good Self Directed Learning there must be given possibilities for each child to find an access to any of the topics dealt with in class. There must be a basis for each child to take a step forward in his/her development.

This is not a simple task for the teacher and often it is not possible to realize this in total. But during preparing a lesson the teacher has to look out for different possibilities of access and take account of the different situations of life of his/her children in class.

There is a second point of good instruction we have to bear in mind. Children do not only learn in school. Therefore it is an important task of school to help children to order and structure their diffuse and unstructured knowledge and experience which deliver the children in school.

Week-plan is besides of free work and project work the most popular form of Self Directed Learning. But it cannot be put on the level as differentiated teaching. An empirical research of Huf (2000) e.g. has shown that children see week-plans not as possibility for individual work but more as a set task which should be fulfilled as fast as possible with using time-saving tricks. This means that undifferentiated week-plans can be seen only as a little variation of tradition exercise courses. Jürgens (1996, 1965) for example could find out by an inspection of teaching research concerning Self Directed Learning that Self Directed Learning cannot do without a clear structured and task orientated arrangement of learning. Hereby it is important to find a balance between structured openness and course orientated closeness, between spontaneity and checking, between distance and closeness, etc. In principle also for Self Directed Learning we have to respect the findings from Weinert and Helmke (1997) in their SCHOLASTIK-study that for an achievement promoting education clearness of demonstration, efficient management, control of the class and positive social climate in the class is important.

In this way I will speak about "Self Directed Learning" or "Developmentally Appropriate Teaching" or "[Minimally Invasive Education](#)". *I would define "Self Directed Learning" as a teaching which is doing what the child does need.* If the child is able to learn by themselves so it must get the possibility to do so. If the child is not able to learn by themselves the teacher must give him the help which the child does need. Self Directed Learning means in my comprehension that the teacher always is ready to help or to go in the background. Self Directed Learning in my comprehension first and foremost does not mean openness in respect to the methods and social forms but *openness for the child* with its special circumstances.

Very important in this way of thinking is that the teachers must be capable to diagnose the learning ability of each child. This is very difficult and demands knowledge, endurance and attentiveness. Often the teachers do not learn this in the field of study and so they can not help the children really. Thus in the preserves as well as in the in-service study of teachers the diagnosis of children and the main points of Self Directed Learning in the above named way have to be discussed – and this means in the pedagogical part as well as in the part of didactics of mathematics.

In the following the necessity of structuring Self Directed Learning will be made clear with some different points of view.

1. A clear structure of courses of events at school is required as already seen by Weinert and Helmke. This is no contradiction to Self Directed Learning. Clear structures, a noticeable thread (developed by the teacher or/and the pupils) make instruction efficient and comprehensible for all pupils. Clear structures reduce incertitude on which children are suffering on often and they bring calmness to the courses of events.

The pupils need guidance for systematic learning. Systematic thinking and acting is for the future of the children important more than ever. The learning with a special systematic makes it possible new contents of learning to integrate into the existing knowledge and understanding in a new wholeness. This is necessary for children with problems of learning in particular but also the others need help to sort and integrate the plenitude of knowledge and experiences.

Also several children sometimes need a course orientated and teacher centred instruction. In an Self Directed Learning the teacher can work with one child a while whereas the others work by themselves / in groups if the structure of working is clear for all of the pupils.

2. A solid preparation and postprocessing of instruction is necessary for open instruction. During scheduling the Self Directed Learning the teachers have to look into the object of instruction as well as discuss different learning proposals, ways of structuring approaches to solve the possibly appearing tasks and solutions. If the teacher in our situation named above did ask him/herself which conceptions, hints, situations, detections, narrations, experiments, models etc (cf. Klafki 1963, 141) he/she would have found out that for Simon and Jonas then his/her given tasks would be different. Self Directed Learning requires a good preparation with reflection on aims and topics as well as social and institutional conditions. This is not in contradiction to Self Directed Learning because once during the performance you can let go the pupils their own ways and another time a good preparation avoids excessive demands as well as under-challenge, idle time and blind actionism. Nevertheless the pupils will not be restrained in their freedom to look out for own focuses, planning of time to work on a special problem, to develop own ideas, to manage team working, etc.
3. Self Directed Learning needs a personal responsibility of the teacher more than ever. The teacher can not just give a task and then let work the children. The teacher can not behave laissez faire. He/She has to bring in him/herself much more than in traditional teaching namely not so intensive in respect to the object but more intensive in respect to the subjective demands. Thus a teacher in Self Directed Learning must have the ability of noticing and making a diagnosis.
4. Self Directed Learning is no grab box where you can pull out this or that. Moreover Self Directed Learning does not mean “take any working sheet you want” out of a pile of different working sheets concerning one topic. Unfortunately often this will be mixed up with Self Directed Learning. Do you really call the decision between some trivial working sheets a free decision whereby the children can learn about decision doing? The Question how self-determined a child can work on a course can be answered only individual. One child may open oneself for a special topic only after the teacher did give guidance for a small walk on this way and another child does see an access immediately. Learning self-determined does not mean without adults. Self Directed Learning can not be measured by the extending of guidance through the teacher. The degree depends on the amount of alternatives the children do have to develop themselves.

If one bears in mind all named conditions of Self Directed Learning then Self Directed Learning leads to a good instruction with intellectual, emotional and social development of all children. But of course it is not easy to perform such a good open instruction and not at all times a teacher can perform a good instruction. But most important is that at any time the teacher goes to great length with such good Self Directed Learning. This does include that the teacher reflects on his method and social conditions.

This in particular demands a teacher training with reflection on these points as well as good mentoring while making experiences in school. Let me demonstrate this with an example about a “poor” teacher.

A teacher-student was watching a class while the children did handicrafts with paper. She asked the teacher why the children should do so. After a while the teacher answered that the children like to do that.

If the teacher would have answered that he/she did not have time for preparation (of course an answer which would not be good with an inspection) so it would have been a candid answer which shows that he/she exactly knows what he/she performs and why he/she performs like this. No teacher is free to do anything anytime anyhow.

Return to our example:

What should the teacher do with Jonas and Simon? He/She could give Jonas new special tasks about symmetry to challenge him but not overtax him. And Jonas could write a fairy tale that is playing in Christmas Eve to show his fantasy. On the other hand the teacher could take time to explain Simon the arithmetic tasks while the other children are working by themselves. Later on Jonas could discuss with Simon a plan to construct an electric equipment in a little house. So both boys can win new knowledge and social competences

As summing up I would say:

For any instruction - open or not open - it is important that pedagogical and didactical acting does have a good basis with passable aims as well as a thread and a clear structure.

Literature:

- Graumann, G. & Graumann, O. (2001). Symmetry teaching in heterogeneous classes – Common learning with handicapped and gifted children in regular classes. In: A. Rogerson (Ed.) Proceedings of the International Conference New Ideas in Mathematics Teaching, Palm Cove (Australia), 80 – 84.
- Graumann, O. (2002): Gemeinsamer Unterricht in heterogenen Gruppen. Von lernbehindert bis hochbegabt. [Common Education in Heterogeneous Groups – from Learning-disabled until Intellectually Gifted.] Bad Heilbrunn (Germany).
- Graumann, O. (2004): Fordern und Fördern: „Problemkinder“ in der Grundschule. [Demanding and Assisting: Children with Problems in Primary School.] Baltmannsweiler (Germany).
- Huf, Ch. (2006). Didaktische Arrangements aus der Perspektive von SchulanfängerInnen. Eine ethnographische Feldstudie über Alltagspraktiken, Deutungsmuster und Handlungsperspektiven von SchülerInnen der Eingangsstufe der Bielefelder Laborschule. [Didactic Arrangements from the Perspective of sSchool-Beginners – An Ethnographic Field Study on Everyday Practice, Models of Interpretation and Perspectives of Activity from Pupils at the beginning of the Bielefelder Laborschule.] Bad Heilbrunn (Germany).
- Jürgens, E.(2004). Die ‚neue‘ Reformpädagogik und die Bewegung Offener Unterricht. Theorie, Praxis und Forschungslage. [The ‚New‘ Reform Pedagogy and the Movement Self Directed Learning – Theory, Practice and situation of research.] 6. Auflage, Sankt Augustin (Germany).
- Klafki, W. (1963). Das pädagogische Problem des Elementaren und die Theorie der kategorialen Bildung. [The Pedagogical Problem of the Elementary and the Theory of the categorical education.] Weinheim (Germany).
- Leneke, B. (2008). Offener Mathematikunterricht durch Aufgabenvariation. [Self Directed Learning in Mathematics Education via Variation of tasks.] In: Vásárhelyi, E. (ed.) Beiträge zum Mathematikunterricht 2008, Münster (Germany), 557-560.
- Müller-Philipp, S. (2007). Zur Überbetonung offener Arbeitsformen im Grundschulunterricht. [About the Overemphasis of Self directed Forms of Working in primary school.] In: Grundschule 39, No 5, 49-51.
- Weinert, F.E. & Helmke, A. (1997). Entwicklung im Grundschulalter, [Development within Primary School Age.] Weingarten (Germany).