

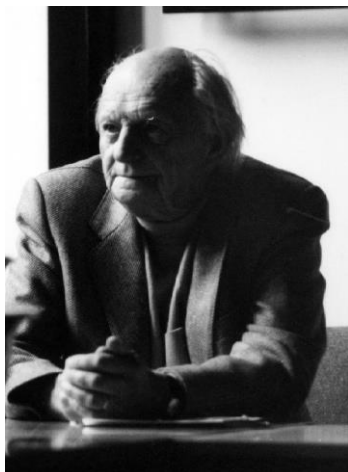
Martin Wagenschein

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1. Passport



Martin Wagenschein, Gießen (Germany) 3 December 1896 –
Trautheim-Mühlthal (Germany) 3 April 1988

2. The teacher

He stood bent over the compass, staring at it. The needle in the round box was still trembling a little but then it settled defiantly in one place: there was north. Turning the box made no difference. There! This way, and I won't be confused! There it is. 'What does this needle 'know' that we do not know neither feel?' muttered Wagenschein softly by himself. 'How shall I convey this to my pupils in the next physics lesson? How can I teach them that? No, not by telling them, for my pupils have known this phenomenon for quite some time already. No, something else is at stake, something that is much greater. We little people, in search of knowledge, live on an enormous sphere. It is so awesome. And such a small needle willingly follows something that seems very far removed, the magnetic north.'. Suddenly this teacher of physics came upon a marvellous plan. In front of him he saw an enormous iron rod turning on a thick nail. Would such a huge thing also obey the 'call of the north'? Then how great should the power be that attracts it?

Encouraged by his former colleague Prof. Dr. Otto Friedrich Bollnow Martin Wagenschein in 1951 published this lesson in physics for children. In his publication he wrote: 'Although we physicists were not at all uncertain that 'it' would attract and determine the direction, I was still remarkably worried and waited with bated breath.'

Wagenschein interpreted his tension as follows:

'It wasn't caused by a form of uncertainty or doubt about the result we expected. It was rather, completely against my own better judgment, a form of astonishment: how can a huge piece of iron answer to the call at such a great distance? And it did!'

Why did Wagenschein go to so much trouble to explain something that had been explained in the school books long ago?

Study question

1. Can you name something from your experiences at school which is a comparable example of research associated with a phenomenon?

3. Historical context. Wagenschein's course of study

3.1 From an authoritarian to a democratic style of teaching

The situation in regular education of Western Europe and especially in Germany just after 1945 was characterised by an authoritarian style of teaching (Kind und Kunst 1977, 158, 183, 211). In the classroom children always sat alone or two together in rows behind one another. The cleverest children sat at the back, the 'slower' ones at the front. The person who taught stood in front of the class and determined what had to be done. The blackboard, book with the syllabus and the wall chart were illustrations of the way teaching was done: entirely facing forward and directed by the teacher. The children were only allowed to say something or to get up from their seats when they were asked to do so. There was no scope for discussion with the teacher or with fellow students. Deviating from these principles was regarded as an infringement and was immediately reprimanded. Open humiliation was a normal way of punishment: standing in the corner or even forms of corporal punishment like pulling hair or ears, sealing talkative mouths with tape (even for young children), writing stupid lines, detention after school. 'Blaming and shaming' was a daily practice. Nobody complained about it. Parents accepted this way of exercising authority and sometimes even added more punishment (Riefling 2012, 12; Müller 2007,68).

Many children, in particular those who found the subject matter or the tempo difficult, experienced the atmosphere in class as most unsafe, which had a negative impact on their attitude to learning. On the other hand the pupils who did best, were openly praised, favoured and rewarded with pleasant tasks, high marks or even sweets. Their feeling of intellectual superiority was substantially stimulated and in this way increased the social inequality which could often also be seen by the difference in the way children of rich or poor parents were dressed. By praising and punishing the teacher prompted an undefined and undesirable group dynamics. Until late in the sixties of the twentieth century this approach was the normal practice in schools, both in primary and secondary education.

Around 1940-'45 the prevailing view on education and teaching was overturned (Kind und Kunst 1977; Read 1942, 292-295). The greatest issue over which the governments of the allied countries, in particular in London were puzzling, was the problem how it came about that a Christian country (like Germany) that had such a rich culture and tradition could be reduced to such a rigid dictatorship and barbarism. Especially the Neurenberg trials (1945-'46) brought to light that the accused – intelligent people – had not been bearers of Christian values and of the idealistic philosophy of the Enlightenment. These perpetrators even refused to face their moral accountability. Somehow the education and teaching had failed. The cause of this failure in upbringing was sought in the rigid and despotic system of German education. The line of thought now was that that generation had not learned to think for themselves. They were actually presented with the great values of their culture and traditions but these had not been internalised. The severe discipline had pushed aside morality. That is the reason why these people had acted so obediently and unscrupulously. The good aspects of their education, the culture and the rich Christian tradition had not formed them to be bearers of culture who were able to judge for themselves on moral-ethical issues.

The fact that the nature of these educational practices in Germany initially differed only in degree from that in the other countries of Western Europe was not observed by the governments in London and Washington. The formative goals – which were swiftly adapted to the demands and instructions of the Nazi-ideologists when Adolf Hitler took over in 1933 – were indeed utterly indoctrinating but were quite well aligned with the current practices in normal education. The Reformational teaching of amongst others Paul Geheeb was a notable exception. Under the pressure of the social developments even a notable number of academically schooled adults, among whom civil servants, judges and professors, tacitly accepted the new Nazi ideas and finally emerged as willing to commit crimes against humanity (Kind und Kunst 1977, 163).

Since 1945 the American and British governments went to work on implementing their view of education: a denazification of German education because they were afraid of a repetition of the anarchy (like that of after World War I). All attempts were directed at the ideal of the Enlightenment of an autonomous (free and equal) thinking humanity for the sake of a peaceful society. Therefore the Americans introduced into the liberated Germany the pedagogy of John Dewey (1859-1952) who even before the war had spelled out the ideals of a democratic education following the American view. His approach became known as 'progressive education'. He was the pedagogue who realised the importance of the *museum* as an educational place. Only there, where the authentic things are, does learning take place. The society he envisaged was in the first instance a form of democratic association (of teachers and pupils) working from a common experience which they share with one another. The concept 'experience' Dewey summed up concisely with: 'if it works' (Bruner 1979, 113). However, that was not the way Wagenschein saw it. The school was the perfect place where the new society had to be prepared.

Study questions

2. From authoritarian to democratic. The transformation from an authoritarian to a democratic style of teaching represents – to both teacher and pupils – not only great benefits, but also serious drawbacks. Reflect on two benefits and two drawbacks of such a democratic style of teaching from the perspective of your own cultural situation.

3.2 Against the current: the dominance of the scientific paradigm over that of the humanities

The essay that Wagenschein published in 1951 (Wagenschein 1965, 204; 1989, 67; Köhnlein 1998, 12) in the last instance dealt with the question how wondering about things can be coupled with expert knowledge. His colleagues, teachers of physics from the fifties, had great reservations about Wagenschein's view of physics. In the scientific thinking of his time there no longer was any room for wondering: for weren't there hypotheses, scientific models, facts, knowledge or the not-yet-known?

Wagenschein on the other hand was conscious of this far-reaching process of change. Was it a case that logic has a monopoly on truth? This scientific way of thinking controlled the German teachers, the headmasters and almost everybody else. It seemed as if the scope there had been in the humanities for the unspeakable had disappeared. The scientific way of thinking became determinant: things had to be measurable, verifiable and logical.

Because religious, philosophical, historic and art themes (humanities) can hardly be quantitatively reasoned out or scientifically researched, and they cannot be isolated as phenomena 'by themselves' either, they went on the defensive. However, in the humanities and therefore also in education issues are dealt with as themes which rise above the measurable and logical. What is at stake in these are phenomena that concern humanity as a whole (issues concerning humanity). This forming or education of the spirit, called 'Bildung' in German philosophy and pedagogy, had come under pressure. Since scientific thinking gained the upper hand – beginning from approximately 1400 AD – the religious commitment of Western Christians gradually waned (Hazard, 1938; Damasio, 1994). The drama of the two World Wars accelerated this process but it was obscured by the economic miracles and the unprecedented abundance in Europe after 1945. This reconstruction led to a new optimism and consumer behaviour. Happiness was now within reach of everyone. This materialistic enchantment deflected attention from a more reflective attitude to life (read: religion, ethics, art) to an attitude where life was filled by everything material. Wondering about phenomena did not fit into this – for wondering could not be understood in terms of usefulness – and so the act of being wondered lost its value in this worldview.

A far-reaching change had been introduced with far-reaching consequences; a significant paradigm shift that led all of us into a new view of reality. This (scientific) worldview was not only presented as a *model* of thinking and organising but as the ultimate truth. Wagenschein protested in his own way by coupling his teaching in physics with philosophy and by an outspoken aesthetic way of acting: the exemplary-genetic method in learning processes. This educational principle envisaged not only the slow, 'developing' way of learning in which children made the issues their own (Individualgenese) but also an essential attention how scholars in Western science had developed their ways of thinking before our time (Sachgenese). Wagenschein did not find it strange that children or students had difficulty with the subject of physics. For indeed, think how many centuries it took the 'best brains' (from Pythagoras to Einstein) to bring physics to the present point of knowledge. About three thousand years! This genesis of Western culture – the history of science as a subject – Wagenschein intertwined with his teaching.

Study question

3. Summarise in two hundred words the contents of the paradigms of both science and the humanities.

4. Comprehension and understanding

In Wagenschein's pedagogy and didactics the concept 'Verstehen' (comprehending) forms the basis of all teaching and learning. 'Verstehen' (comprehending) is always used in relation to 'Begreifen' (understanding or grasping); the concept originated in nineteenth century German philosophy. The German philosopher Wilhelm Dilthey (1833-1911) applied the concept 'Verstehen' to denote the contrast in forming concepts between the scientific reasoning (Begreifen) and research in the humanities (Verstehen) (Lorenz 1998, 80). In the Dutch language 'verstaan' (comprehending) is often regarded as synonymous with 'begrijpen' (understanding), although the latter concept is actually nothing more than a translation of 'Begreifen'. Wagenschein made a connection between 'Verstehen' and the French concept 'enracinement' which he translated with 'taking root'. Knowledge should be able to grow when it has taken root in fertile soil.

4.1 Subject teacher or pedagogue

In his teaching novellas, written for teachers and students, Wagenschein maintains a balance between two positions: (1) the expert with his astute observations and the arguments which flow from these; (2) the pedagogue who in his observations lends significance to the naivety of the child. These teaching stories were at odds with the contemporary logical-mathematical paradigm of objectivity and abstraction. A physical argument would have to be conclusive and abstract in a logical sense but Wagenschein also described freely his state of mind: his astonishment (Staunen) about overawing phenomena. He even set it as a didactic condition for successful teaching. Because his colleagues saw the discipline of natural science as an instrument (what can one do with it) and not as formation of meaning (how does it open up reality), no scope remained 'to be overwhelmed by not-knowing'. This deeper knowledge calls for pausing humbly (Stehen) at the things, known in German philosophy as 'Verstehen'. That is much more than the desire to grasp (Greifen) the phenomena in formulas, numbers and algebraic language, in other words 'Begreifen'.

4.2 Back to the phenomena

Wagenschein rejected the modelling approach of the normal teaching of physics and with it also the answers thus obtained (Begreifen), because good teaching should start with the child's ability to comprehend. Children do not observe in this way. These academic

strategies surreptitiously rob children of their open-minded, naïve reasoning, and later on also of pleasure in the subject. He avoided intricate apparatus: it does supply data, but the physical phenomenon itself disappears. Wagenschein looked for new, simpler ways of making visible the phenomena as they appear to children in daily life. Therefore Wagenschein preferred an ordinary beer glass and a washbasin (atmospheric pressure), a magnetic piece of iron ore (magnetism of the earth) or the fountain on the plain with its jet of water (the laws of falling). This was the ongoing forming of didactic principles derived from the reforming educational insights that Wagenschein had learned from Paul Geheeb. This is the man who had formed him to become a pedagogue and didactician. As an activating form of work Wagenschein chose for the socratic dialogue, but always beginning with a question or situation that would 'draw them out'. The actual phenomenon had to take central position from the start. By means of a play of questions and (leading) objections the children had to stumble as it were by themselves upon the problems that had occupied the great scholars in the past (Sachgenese). When these phases that a subject science had gone through were experienced and felt anew (although in accelerated tempo) (Individualgenese), then (true) knowledge (Verstehen) could be arrived at. Thus Wagenschein intertwined the history of science with his teaching and simultaneously sought a balance between the subjective (the process) and the objective side (the product) of learning.

Study question

4. Comprehension (Verstehen) and understanding (Begreifen) are concepts from nineteenth century German philosophy. But in a traditional Bible translation we also meet these concepts. Look up five Bible texts in which they appear. Give an explanation of the meaning of the words in the texts you chose.

5. Martin Wagenschein, life and work

5.1 His youth and student years

Martin Wagenschein was born in Gießen on 3 December 1896, the son of Anna Sittig and Raimund Wagenschein. His father was an engineer and worked as a manager and later as managing director in the brick and earthenware factory of Wilhelm Gail in Gießen. Martin finished grammar school but when World War I broke out (1914) he was declared unfit for active fighting due to heart problems and was trained as a male nurse by the Red Cross Service in an ophthalmological clinic. This enabled him straightaway to make a start with studies in mathematics, physics and geography in Gießen. In 1918 he continued his training in Freiburg in experimental physics, cartography and analytical mechanics. In 1920 he received a PhD with a thesis on: 'Experimental research on the co-movement of a ball in a moving fluid and gas mass'.

5.2 His development to a teacher; the war years

From 1924 to 1930 he was a teacher in Hombachtal at the Odenwald School. The school, organised on reformed educational principles, functioned as an anti-authoritarian learning and working community, the members of whom initially lived and worked together as one family with one teacher 'as father' in one home. The pupils had to learn to work together and to take equal responsibilities. The teachers came from various countries and formed a mixed company. The organiser and director was Paul Geheeb. He remained that until 1934. The years under the supervision of Geheeb were decisive to Martin Wagenschein for his further development as a pedagogue and didactician. During this period at the Odenwald School Wagenschein discovered that he not only had to teach a subject but also had to become a pedagogue. Everything that a teacher starting on his career needs, Wagenschein found and learned from Geheeb: courage and intensity, spontaneity and limiting subject matter, a certain freedom of choice for the

child and themes organised in parts for a day. His most crucial educational discoveries were that (1) children want to learn and when this seems not to be the case, the reason mostly lies with the teaching and the teacher himself/herself (2) that mutual trust is needed between teacher and pupil as well as (3) self-confidence of the child and confidence in the subject matter. As a teacher he developed a worldview that was remarkably modern at the time:

'Thinking about nature is not in contrast to accurate research of nature. Physics is not even an essential characteristic of nature, for it develops a dominant but (also) a limiting aspect of nature.'



National socialist tuition at the Odenwald School

Both during the political revolution of 1933 and the changes in education in national socialist sense, and during the war years from 1939-1945, Martin Wagenschein worked as a teacher in the vicinity of Darmstadt. In 1933 he chose to join the national socialist charity society (Volkswohlfahrt) – where he became the treasurer – and also the national socialist union of teachers of which eventually seventy-nine per cent of the German teachers were members (Kind und Kunst 1977, 163). Paul Geheeb felt compelled to flee and emigrated to Switzerland. There he founded the École d'Humanité, first in Versoix on Lake Geneva (1934) and later in Hasliberg-Goldern (1946). Wagenschein did not follow Paul Geheeb to Switzerland in 1934 but thought that he would be able to pass unnoticed through this difficult political period. In his own

texts Wagenschein does not record anything about this period and his dedicated former students prudently do not mention this period in their biographies (Berg, Eisenhauer, Kohl).

In the meantime Martin Wagenschein exhibited an enormous productivity. In sequence were published (1933/34) 'Zur erzieherischen Aufgabe des mathematisch-naturwissenschaftlichen Unterrichts', (1935) 'Physikalischer Unterricht und Intellektualismus' and (1935) 'Zusammenhänge der Naturkräfte'.

In 1938 Wagenschein even entered the NSDAP, which given the circumstances, was the best way to keep on working. However, after World War II he was cleared from all blame, probably due to the intercession of his former friend and colleague, Prof. Dr. O. Bollnow, by then a famous educationalist. Wagenschein must have found it difficult himself, as if after a nightmare, for in 1945 he wrote:

'Spring 1945. The war is over, freedom has been gained! Together we stand under ruins turning green: now the school, too will have to become completely different! An old dream from childhood is being fulfilled: the schools have been burned down! An old dream of a teacher has come true: after many free weeks in summer a few children from the neighbourhood came to the teachers, at home: they wanted to learn' (Mereth 2004, 193). Wagenschein was of the opinion that the authoritarian structures in education would now definitely be broken out of. The reformed pedagogic ideals for education could now become a reality.

When he visited Paul Geheeb in 1950 at the École d'Humanité in Goldern, he was struck by the community ideal that had once again been realised. He wrote down his observations: 'One could not see who were the students or who were the teachers, due to the relaxed way they engaged with one another (the freedom to become yourself).

Servants were not to be seen: from the youngest children to the older, they were all conscious of their duties. The care for the garden, looking after the flowers right through to keeping clean the rooms in the boarding school, everything seemed as if running by themselves. The children did not stand to attention when a teacher passed them and did not stop talking' (Wagenschein 1980, 77-84).

The climate of education was, the way we would say it today, 'anti-authoritarian'. The uninhibited joviality of everybody, the relaxed movements and solidarity, with which older girls in a natural way danced with boys of twelve, in particular attracted his attention: 'In a community educating themselves in this way, the pupils were no subjects, but happy participants.' Later on Wagenschein once more looked back to this period and mentioned another source of inspiration: 'The Odenwald School determined my career in educational thinking. The fact that then, and also later on, I did not lose touch with young children and the way they begin to think is thanks to a second and no trifling influence: my wife, who as the guardian and keeper of children's way of thinking supported my work for decades long with understanding and incisive help' (Köhnlein 1998, 9-17). His wife Wera edited all his publications. He used to praise her as the best critic of his work. She herself also wrote: essays and travel reports, in which she can be seen as a sensitive and pensive type with a keen gift for observing how the world is perceived by children. She had wanted to become a pianist.

Study question

5. The threat of war and political tension occur in all times and places. How would you act when your ideals for teaching are thwarted by political circumstances?

5.3 To the full development of exemplary thinking

After the war he became a lecturer in Traisa, in the neighbourhood of Darmstadt, at a school that was just being started. From 1949-1963 he worked as a lecturer at the Pedagogic Institute in Jugenheim, from 1952 to 1987 at the Technical University in



Martin Wagenschein with his spouse Wera

Darmstadt in 'practical pedagogy'. Moreover he gained a chair in pedagogy at the University in Tübingen (1956). The following year he was awarded an honorary professorate which he held until 1978. During these years his most well-known publications came out, in total a full three hundred, as (1956) 'Zum Begriff des Exemplarischen Lehrens' [Towards understanding exemplary teaching]. After his retirement in 1957 he got even more opportunities to pen down his ideals for teaching. Thus he also wrote (1962) 'Die Pädagogische Dimension der Physik' [The pedagogic dimension of physics], (1965/1967) 'Ursprüngliches Verstehen und exaktes Denken' and (1975) together with Hugo Kükelhaus 'Rettet die Phänomene'. He received several honorary distinctions and prizes (1955, 1969, 1985, 1986). On the morning of Easter Sunday, 3rd April 1988 Martin Wagenschein passed away at Trautheim. His wife Wera followed him three months later. Their marriage had been childless.

5.4 Against the current

Due to the rapidly expanding knowledge in science and technology, in particular in the field of physics and mathematics, subject matter dealt with at universities were shifted to the last 2 or 3 years of secondary school during the fifties of the previous century. At

the teachers' conference in Tübingen in 1951 (die "Tübinger Gespräche") where this development was discussed, Wagenschein caused a sensation by objecting against overloading the syllabi of the secondary school. Wagenschein there set out the principles of exemplary learning. In 1957 Wolfgang Klafki provided a theoretical foundation for this which in addition pointed out its social relevance. For many teachers felt compelled to restrict themselves while teaching to learning 'tricks and trucs'. The children would then have 'understood' the subject matter. Wagenschein on the other hand, emphasised learning to think the way required by mathematics and physics (Verstehen); also the necessity of strategies of learning to acquire fundamental knowledge, with emphasis on an open learning situation, a moderate tempo, an attitude of investigative learning, starting with concrete situations and avoiding abstractions. Only in this way, he maintained, could a child reach 'deep understanding' and identify with the themes taken from daily reality. What had been learned first had to take on meaning in the pupil's life before a subsequent study in a certain subject would be possible. This was the only way a pupil could be prepared for thinking scientifically. On the other hand all matters swiftly learned (by heart) would usually be forgotten quite soon, even if they obtained good marks. Although Wagenschein was not stating something new, merely building on the tradition of the reformed educational principles, what he said was directly opposed to the view on the subject held by many teachers and colleagues teaching the subject in Germany. In the Netherlands, too, the prevailing practice had become fast learning and understanding because of the so-called pressure of time.

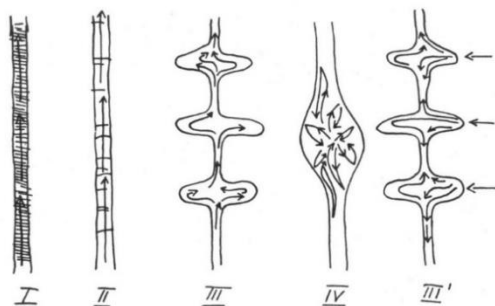
Study question

6. What is the main difference between teaching with the aid of 'tricks & trucs' and the way in which Wagenschein presented his subject matter?

6. Source text

Martin Wagenschein. Teaching to Understand. On the Concept of the Exemplary in Teaching

I. Let us begin by looking at what we have to steer away from if school is not to suffocate from the sheer mass of content and then perish as a kind of subject-matter processing plant. The older and more established a subject is, the stricter we tend to plan the learning steps. I'm thinking of mathematics - in contrast to a younger subject like social science - where we are likely to fall for the temptation to stick with prescribed steps, move from the simple to the complex, leaving out no step in a so-called systematic course of study. In mathematics we at first stay close to the axioms. In physics we begin with skills such as measuring, introduce basic concepts, and teach



mechanics as the birthplace of physics. In biology we go through the world of the animals in linear fashion, starting with one-celled organisms and ending up with human beings (or the other way round), moving from the past to the present, step-by-step. In these approaches, the essential thing seems to be: Every single detail serves as a small stepping stone, leading the learner to something more complex and difficult, which he or she cannot yet grasp. (See figure)

The reasons for working in this way are obvious. One thing builds on another, either logically or chronologically. There has to be order. If you leave something out, you will have to pay for it later. Every detail can be important, even if you don't recognize how at the moment. These reasons are "logical," but that is all they are. They are not

pedagogical. They only see the totality of the subject matter and overlook the child. The child is seen as a small adult, quantitatively limited in its ability to grasp things. But to be a teacher means: to have a feeling for the process of human development, for what the human being is growing towards, for the awakening spirit. And to be a subject teacher means to know, in addition, both the subject's being and its becoming within the learner.

The basic principle, 'first the simple, then the complex', has some validity. But this principle should not stand alone. Its shortcoming is obvious: very often simple things are either not really simple at all, or they are trivial. The law of inertia becomes more and more astonishing, the more one thinks about it. To fully comprehend it would need several lives as a researcher, and it is a lamentable thing to see it dished up on page three of an introductory textbook with an explanation that leaves out far too much. Einstein writes that the law of inertia is 'usually the first thing we memorize in school physics, and one or the other person may even remember it'. That certain angles are equal when a line cuts through parallel lines (congruent angles) may be believable, but the fact is too obvious. It is a boring observation that leads to nothing. It merely serves a purpose. Such a systematic course of study doesn't give the learner long-lasting motivation. It only supports an anxious concern for what is to come, for the weighty edifice still to be built (which also burdens the teacher, even though he is familiar with it). The student thinks: what does the teacher have in mind for today? The teacher begins: today we are going to do the following! An inherent temptation is completeness, which leads to haste and a lack of thoroughness. And an impressive heap of gravel is thus built up. Education is not a process of just adding. Just as adding thread upon thread leads nowhere, so also does the selective removal of threads (see number II in the figure above). The fabric becomes threadbare and lacking in substance. The result will be a diluted systematic course of study. No one will think that knowing little is preferable to knowing much. But many a recommendation to give an 'overview' and to offer the material in sweeping brush strokes seems to illustrate such a preference.

The Concept of the Exemplary in Teaching

So what we need are selection criteria. We need to confine ourselves to the essential. Supposing we know the essential, a first worthwhile form for a course of study would be number III in the figure above. We recommend the courage to leave gaps, which means the courage to be thorough and to dwell intensively on selected topics. So instead of evenly and superficially walking through the catalogue of knowledge, step-by-step, we exert the right - or fulfil the duty - to really settle in somewhere, to dig in, to grow roots and take root. We don't want dissolution and isolation, we want continuity, but concentrations and intensifications within that continuity. The particular aspect we delve into is not a stage in a process, but a mirror of the whole. Why? The relation the particular has to the whole, however, is not that of a part, step, or preamble; it is a center of gravity. It may be only one, but it carries the whole in it. This single aspect is not an element in a process of accumulation, rather, it carries and illuminates. It is not a stage in a progression, but it works like a spotlight. It affects things that are distant yet related through resonance. This is what the concept of the exemplary means (see number IV in the figure above).

This is also what Ernst Mach means when he says that as a physicist he "would be satisfied, when every young man" (he forgets the girls) "has shared in the experience, so to speak, of a few selected discoveries of mathematics or physics and understood their consequences." Maybe Lichtenberg points to the same thing when he says: 'Something you have to discover for yourself leaves a trace in the mind that can also be used in other cases.' Confucius, for one, is supposed to have said that he would send that student away who wouldn't understand how to apply in the three other corners what he had learned in the first one. The clearest formulation is in the 'Tübingen Resolution' to become visible through the example of a single thing the student has genuinely understood." I would like to add comments from two participants in the conversation at Tübingen: Hermann Heimpel says) that 'the universal is contained in the particular and

can be found: *Mundus in gutta* (the world in a drop)', and that it is possible 'within the framework of a general survey to come face-to-face with history in particular places, and . to apply this to other areas.' Wilhelm Weischedel speaks of the 'presence of the whole in the parts' and says that 'something of the essence of history only really lights up in a particular event.' (Italics in this paragraph's quotes are added.)

The concept of the exemplary is the opposite of specialization. It doesn't want to get stuck in particulars, it looks for the whole in the particular. 'Impossible!' will be the response of the person who only knows addition.

Since we are primarily focusing here on refining a concept, we could say that radically exemplary mathematics teaching could limit itself, for example, to considering the one classical proof for the fact that there is no end to the series of prime numbers. In doing so it would make visible quite a bit (but not everything) that is characteristic for mathematics. The example is exaggerated on purpose and should not be taken as a proposal. Yet I'm convinced that a single such excursion, granted only that it is deep enough, could reveal more about mathematics than many a person has gotten out of mathematics who passed their finals unscathed. Richard Goldschmidt demonstrated 30 years ago how one can illuminate essential biology simply by looking at a roundworm. Kerschensteiner writes: 'Forty years ago Prof. Götte of Strasburg wrote an excellent booklet in which all essential manifestations, concepts, and laws of the field of zoology were studied and put into context by looking at five to ten animals.'

Spontaneity

So far I have purposely taken a somewhat one-sided approach by starting from the subject matter. But we also need to understand that the other half, the whole and spontaneous child, warrants just as careful consideration. We must consider both child and subject matter in equal measure, that is to say: the areas of intensification - the platforms - should also entail intensification of the activity of the child. They must be vivid and lead into the subject matter and into the soul of the learner. The process of mirroring must not only reflect the whole of the subject matter - ideally the whole of scientific pursuit - but should also bring light into the whole being of the learner (not only appealing, for example, to his or her intelligence).

Approaching and Getting in

Getting into a subject means plunging in - finding a relatively complex problem about which the students have no previous knowledge, a problem that will challenge them and elicit their spontaneous engagement (Figure III).

Take optics for example. Instead of going through the customary sequence (luminous and illuminated bodies, shadows, rectilinear dispersion, darkness, etc.), we could start with a problem that Kepler poses in his *Optics* (1604). He starts with the question where 'sundollars' come from: 'That a sunray, which penetrates through a slit, appears in the form of a circle on the surface beneath, is a fact everyone is familiar with. One sees this under dilapidated roofs, in churches with holes in the windows and likewise under every tree. Attracted by this wonderful phenomenon, people in antiquity have tried hard to find the causes for it. But up to now I have not found anyone who has found a right explanation.' Figure III tries to indicate that we enter from the outside and that energetic thinking leads to the basic concepts (to rectilinear dispersion in this case) and to more complicated questions. A second immersion repeats this procedure on a somewhat 'higher' level, for example, in the phenomenon that Goethe describes: A white pebble in clear water against a dark background seems not only elevated, but also appears to have colored edges, the more so the deeper it sinks. Starting from this experience we can explain all that is involved with refraction and dispersion, lead into the related topic of reflection, and move up from there to the spectrum.

So after plunging into a problem we dive down into what is fundamental and search for what is required to explain it. In this process we no longer amass and store data, but search for what we need, going to work in the same way original research occurs. An uncommon phenomenon demands our attention, and we in turn find the simple within it.

A tried and true entryway into mechanics is the seemingly harmless question 'Where does a stone land that is held out of a tower window and dropped?' Such a question seems trivial at first, but becomes confusing as soon as we think of the curvature and rotation of the earth. The complications are resolved by further thinking that lays bare the law of inertia, a proof for the earth's rotation, and above all: it opens up the way physicists think. The challenge is choosing the problem one starts from. It should neither be too simple nor too complex, and we should not get too fanatical about the whole procedure. Keep in mind that the principle of going 'from the simple to the complex' remains - in a limited way - valid alongside this approach.

Study question

7. Wagenschein did not start with the didactic strategy: 'from simple to complex' but from 'the exemplary to the essential.' Yet he does not wholly discard the first strategy. How is this possible?

7. The influence of Wagenschein's didactics

The ideas of Martin Wagenschein were carried further by his students – Peter Buck (1939), professor in didactics of physics at Heidelberg and Hans-Christoph Berg (1938), professor in general didactics at Marburg. From 1989 onwards Berg and a team of teachers from Germany, Switzerland and the Netherlands who still keep in contact continued to develop the concept of Wagenschein to what is now called 'Lehrkunst' (the art of teaching). From 1994 until 2003 Berg demonstrated this didactics at the Driestar University (in the Netherlands) and coached a number of Driestar lecturers in it. By referring to concrete themes like 'the candle of Faraday', 'the bouquet of Rousseau' and 'the local church' Berg demonstrated his tutor's principles of exemplary teaching. Everywhere he encouraged teachers to design lessons on the basis of the 'exemplary-genetic-socratic' method. These efforts in the countries mentioned have led to more than eighty educational themes, partly physical and mathematical themes (following Wagenschein) but also completely new designs from the subjects biology, history, geography, fine arts and English and German literature. About thirty of these themes were developed in Driestar University alone, and were practised with children many times. Dissertations on these themes also appeared in books or were made accessible digitally. Hans-Christoph Berg not only extended the field on which they worked, since 1995 he also expanded the theoretical foundation. The socratic form of work (following Wagenschein) was now incorporated into a greater didactic principle: the socratic dialogue. This is not a mere play of question-and-answer but the dramatic art of teaching a lesson. The teacher then is the director and the pupils are the actors. This insight emerged from the book 'Didaktik als Dramaturgie des Unterrichts' (1959) by the educationalist Gottfried Hausmann. Since 2015 this dramatic approach was further theoretically and philosophically underpinned by means of a dissertation and defined in more detail from the perspective of playing taking the central role. Because in the socratic dialogue mention is also made of the imaginary aspect of 'do as if', one now speaks of the *aesthetic dimension* in exemplary teaching. The teacher knows the solution all along but he entangles the pupils in a playful approach consisting of stimulating questions and actions and leads them to the outcome (Veldman, 2015). At the Driestar University in Gouda many drafts have been realised and carried out with children or students since 1996, many examples from churches derived from 'House of men-House of God, the St. Jan's church in Gouda'; examples from castles and country estates like 'The Palace 't Loo, a house for Willem and Mary'; diary examples like 'Anne Frank', examples from artists like 'Rembrandt's pictures from the Bible' and examples from literature like 'Jessica's first prayer'.

Although the principles of Martin Wagenschein and Hans-Christoph Berg (Lehrkunst) were not introduced into many schools in Germany, Switzerland and the Netherlands, this pedagogic-didactic view was nevertheless highly praised and given official

recognition by the leading educationalist Wolfgang Klafki (1927-2016) (Berg-Schulze 1997, 13; Nölle 2007, 371). Although in many schools a pragmatic attitude, a thinking in terms of competence and the test culture bar the way to greater depth in the teaching and to reaching 'Verstehen', in this didactics we are concerned with the art of drafting and the dramatic execution of lively teaching (Rohde 2003). Not all teachers have already mastered these skills.

Study question

8. The teaching of Martin Wagenschein and his followers has not enjoyed a general acceptance in European education. What are the problems and what is the solution?

8. The topicality of Martin Wagenschein

8.1 Dialogical relation with the phenomena

With his texts Wagenschein wrote a kind of phenomenology of 'Lehren und Lernen' (Teaching and learning). That is, a reasoned reflection of the subtle, psychological relationships that come about during the learning process between the teacher, his pupils and the phenomena and in which astonishment, wondering and 'Verstehen' are the guiding principles. The fact that Wagenschein regarded the learning process as a continuous dialogue, presupposes that the teacher himself must have thoroughly acquainted himself with his theme (the phenomenon) before he can bring about a dialogue between the pupil and the subject matter. The pupil has to progress from a spectator to a participant, to empathy or, if possible, to identification with the theme. There should be sparks in the lesson. Wagenschein calls it 'Ergriffenes Ergreifen' (becoming emotionally involved). Only then can we speak of a true encounter (dialogue) between pupil/student and the phenomenon. This phenomenon or theme can be a historically significant person, but just as well a bunch of wild flowers, ice crystals, a painting or a church building, on condition that this phenomenon can reveal a greater relationship with reality. During this process the teacher acts as a kind of catalyst (a mediator). He harnesses all his didactic qualities (socratic form of conversation, playful and dramaturgical forms of working) with a sense of timing, diction, pauses, overtones as well as place of activity.

Study question

9. What is meant by a dialogical relationship with the theme of your teaching?

8.2 Embarrassment exposed

Although Wagenschein never spoke about the desirability of Christian teaching or education his pedagogy fits into this canon of Christian pedagogues. The most important argument is that he has pointed out to us (Christians of the twentieth and twenty-first century) embarrassing mistakes in our thinking that we would not have noticed easily without him. Having imperceptibly become detached from a view of reality as held by the humanities – due to our academic training and the spirit of our times – most Christian teachers have been encapsulated in their thinking and acting in a scientific perspective on reality as set out above. It even seems as if this has become the dominant paradigm of Western thought beginning in school, the academic debate, resulting in practices in the church (Hazard 1935; Holmes 2008, xviii). This view to a great extent governs our knowledge and teaching. Serious Christians in the Netherlands are busier *proving* creation and the government of God (in a scientific way) than *admiring* creation and the Rule of God. In education, too, we are constantly concerned with facts, measuring, proving, usefulness and reflecting on the market and there we stop. As a result of this Christian teachers have been greatly embarrassed how to justify what is Christian in their teaching. It seems as if the modern way of thinking has become the only and

compelling train of thought (Van Peursen 1975, 220). Is it a case that the subjects (apart from religious instruction) are regarded as a neutral field because they suppose no Christian arithmetic or drawing could exist?

8.3 Understanding in wondering

Since pupils in regular education need only know the main lines of phenomena, even many Christian teachers treat the contents superficially. The teaching is 'shallow' and therefore the learning is not deep (no 'Verstehen'). So then no Biblical perspective of reality can be uncovered either, for the Biblical message wants to touch the depth of our heart and thus brings about consequences for the interpretation of this world around us. Teaching will therefore never be superficial work. The positivist paradigm with its emphasis on facts, measuring, proof and usefulness is therefore seriously inadequate (Van Peursen 1975, 174). Like Wagenschein Christian teachers should loathe this superficial education and eliminate the positivist paradigm entrenched in it. He sets the example himself because he has strongly criticised this paradigm and offered an alternative. With his didactics of the socratic questions and putting daily phenomena in the centre, he has shown us a passable way to going deeper. For behind the socratic questions about phenomena there appears again and again that marvellous secret that can bring light when we ask the following (religious-) philosophical questions: 'how is it possible that these things just are like this?' Or: 'where does it come from?' Or: 'who invented all of this? Did you invent it?' 'No, not I.' The teacher will then also admit: he himself has not invented it either! Where Wagenschein stopped, because he could not take this ultimate step, this dialogue with religious undertones, we must go further. Because we do know the answer! Therefore, let us get going: for a Christian phenomenology of 'Lehren und Lernen' (Teaching and Learning). By organising teaching more and better socratically, dialogically and aesthetically, by choosing exemplary themes and delving deeper into the themes, opportunities arise for a Christian perspective on learning: for many interesting phenomena have no use, but they do have their secret (Van den Beukel 1990). This kind of teaching we envisage should take one to a Biblical wondering about things, for that is the beginning of the vertical dimension (Van Peursen 1975, 226). That is the Biblical 'Verstehen'. Unintentionally Wagenschein has created the possibility of Christian didactics.

Study question

10. According to Van den Beukel many interesting phenomena cannot be interpreted as useful but in fact as revealing a secret. Can you give examples from your situation in school whether there (also) are situations showing this discrepancy between (on the one hand) the usefulness of what is taught and (on the other hand) the meaningfulness, but not-being-useful?

8.4 In conclusion

Although we do not take over all Wagenschein's opinions – such as the anti-authoritarian education, the recapitulation theory, the magic reasoning of the child – nevertheless he takes us from a fleeting view to a meeting with the phenomena; from superficial 'grasping' to deeper 'understanding'. He leads us back to a Christian understanding of this reality. For we do confess: it is God's reality given to us humans to use, to work on, for us to rejoice in and to notice God's great deeds in it. Therefore back to the confession that none of it is ours; that we have not constructed it ourselves. We still have only a slight knowledge about it and insight into it. So back to the wondering and contemplation of the miracle. Christian teachers therefore have one more step to go: from the miracle to the Creator and Keeper of this reality, 'For from Him and through Him and to Him are all things' (Rom. 11:36). The bond with the Reformed tradition, as articulated in the Belgic Confession, Article II (the knowledge of God from nature and the Scriptures) should be practised more. Organically Martin Wagenschein therefore fits into a Christian pedagogy.

9. Primary concepts

What Martin Wagenschein worried about was the superficial way teaching was done in many schools. Therefore he emphasised that good education should delve deep. So there was no getting away from slowing down the tempo considerably; the periods of fifty minutes at many schools prevented this. The overloaded syllabus with a multitude of subjects necessitated teaching to be confined to main points. That brought Wagenschein (and H.-C. Berg) to the following primary concepts:

9.1 Exemplary teaching.

The choice of the theme should be of such a nature that in the choice other related subjects would develop that could be used as examples. From small things greater and more complex phenomena become comprehensible. The theorem of Pythagoras therefore is not to learn a trick or formula, but to puzzle mathematically about adding up and subtracting squares (Brünger 2004). In this way thinking and working mathematically can be learned. The second develops from the first. Therefore the exemplary is a principle that encompasses all subjects.

9.2 Genetic learning

Learning should start two processes: (a) the pupil himself goes through a learning development. The example mentioned in 9.1 initiates him from a simple cut and paste activity into thinking mathematically: how do you add up two squares so that a third square is formed? Or the other way round: how do you split up a square so that two squares are formed? Subsequently, how do you write this down in letters and signs? (Brünger 2004, 25-31). The second process (b) concerns the history of the theme or phenomenon: the problem brings us into contact with the past. Before we can understand the theme in the present, the pupil must also occupy himself with the development (the genesis) of the thinking on this theme. Seen thus a single Medieval church is adequate to understand both the development of the medieval churches of Western Europe in their main line of thought and that of the religious thinking (Dörfler 2001, 181-224; Veldman 2015, 82-85).

9.3 Socratic teaching

It is the first duty of the teacher to create a powerful situation and have ready an 'enticing question'. Subsequently he opens the conversation by means of a socratic conversation that has been logically organised. The teacher should be geared to draw the pupils into a dialogue with the phenomenon to be dealt with. In such a lesson situation the teacher answers the questions put by the pupils in counter-questions that give direction to the conversation. The object is known to the teacher but not to the pupils. The socratic approach also contains a 'do as if' effect, the shortest definition of play. However, the teacher stays the wise educationalist. He may not discourage the pupils or drive them to despair. When the learning process becomes bogged down he can devise a way out by mediating with a story, a short explanation or another form of work. Since 1995 socratic questioning has been defined by H.-C. Berg as a form of dramatic acting, that means, something that brings about imagination (Berg/Schulze, 1995).

9.4 Dramaturgical learning

Dramaturgy as a way of explanation initially developed in the artistic setting of the theatre. This means that the teacher could learn from the art forms, for in dramatic art an adult shows what can be conveyed to the hearer by means of a staged situation, a gesture, use of the voice, narration, moments of silence and evoked imagination. As a skill for teachers dramaturgy therefore is the didactic form in which a combination of narrating, gesticulating and acting carries the theme in the desired direction by suggesting certain things (calling on the imagination).

Study questions

11. Summarise in your own words the key concepts: exemplary, genetic and dramatic. Explain what changes occur in the teaching when a teacher does not have the qualities for socratic / dramatic teaching.

10. Suggestions for acting

What is the significance of wondering in education? [part out of a lecture; to be published in Grand Rapids USA, Jan Veldman]

Because it is impossible to force the students into experiencing wondering, I always try to translate these questions or classroom situations into ways of acting. In my art lectures I teach my students how to investigate their subject. The strategy we use isn't simple drawing, painting or modelling, but it is playing with the possibilities of the theme itself. (1) With the things themselves that are right under our noses. (2) With the possibilities of the artistic materials. (3) Especially with the feelings and expectations of my students. In my lectures about snails I displayed many empty shells, big and small ones, on a table with a blue tablecloth at the front of the classroom.[see illustration] In a vessel I brought many live baby snails into the classroom. I chose these funny babies, because I experienced that my students were afraid of big, ugly and wet snails, but found the little baby ones endearing! Therefore babies. (thus playing with their feelings) In a dialogue we first inspected the empty shells that were displayed on a covered table as if they were works of art. (A bare classroom table would not have been fitting.) The students were allowed to take one shell for themselves and inspect their choice with heightened attention. (thus playing with their expectations)



Then an open Socratic dialogue is started. Most of the students did not believe these examples were real. Because of their impressive colours and the unexpected variations of forms, they thought these shells would have to be artificial. In a situation like this my role is to silently wait. (thus playing with their confusion) At this point supplemental information is not helpful. There has to be space for a first spark of wondering. After a while I will provide some information about these phenomena (insofar helpful). Especially the baby snails on their tables are fascinating and holding their attention. Then a Socratic dialogue will continue, as follows:
How does a little snail live? And what does a creature such as a snail need to continue its life? Simple questions like these evoke many other questions, such as: How are little

baby snails brought into this world? Do they hatch from eggs or do snails give birth to live young? Does it have a father and a mother? How can it grow up into an adult form? Does it have a mouth, teeth, a stomach, eyes, hands or feet? Will it leave its shell several times, to look around for larger accommodation?

The students notice that the theme is obvious simple and that everybody can take part in this questioning (thus playing with their expectations to overcome bad experiences).

The students assume that the shell of a snail is made of a rather rigid material and therefore unable to grow. And that is the very moment for the lecturer to stay silent and wait. The students have to discover their own ignorance. I am, of course, playing with their emotions suggesting that I don't know it myself.

The life and growth process of a snail is unexpected and therefore amazing. It is not our purpose to examine (with a lancet) its internal anatomy, because before I took them out of my garden I promised these creatures (empathy and dialogue) that they would leave our classroom in the same way as they came in: alive! To investigate their anatomical structure I therefore had to look for other ways: art education and dramaturgy, which I cannot present here.

In my art and history lessons the dialogue is a very important factor; not only the dialogue with each other and with our students, but also a dialogue in the sense of an attentive investigation with the things (phenomena) around us. This entails much more than simply being satisfied with the straightforward answers we find in our computers and books. This is thinking and studying on a deeper level: the didactical art of accepted ignorance. Only then can we cross the thresholds of our proud intelligence; by making new connections with our students, with the subject matter, with the complex reality around us and with our own ability to teach. It enables us to recover the driving forces of learning and lecturing.

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