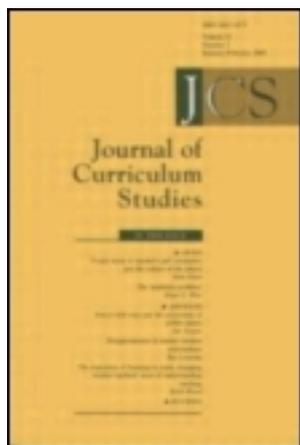


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Has John Hattie really found the holy grail of research on teaching? An extended review of Visible Learning

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REVIEW ESSAY

Has John Hattie really found the holy grail of research on teaching? An extended review of *Visible Learning*

EWALD TERHART

In this article the author reviews and discusses John Hattie's book *Visible Learning*. In this book Hattie presents the results of a meta-meta-analysis on the conditions of successful teaching and learning in schools. Hattie's work is based on more than 800 meta-analyses, and these meta-analyses are substantiated by more than 50 000 empirical research studies. Among the six groups of factors influencing successful learning in schools—student, home, school, teacher, curricula, teaching—the factor 'teacher' seems to have the strongest effect. Hattie not only evaluates empirical research but also places the results in a theoretical context of a theory of teaching and a certain concept of teacher professionalism. The author discusses Hattie's approach to combine empirical research and conceptual work on teaching and on teachers' work. The limits of meta-analyses and future meta-meta-analyses are pointed out.

Keywords: teachers; teaching; successful learning; meta-analysis.

Visible Learning can be regarded as a milestone in the research and debate on the conditions for successful learning in schools. John Hattie's monograph is unique because such a broad reassessment of research on the conditions of successful school learning has not yet been given: it is based on more than 800 meta-analyses into which more than 52 637 individual studies have been integrated. The list of references includes about 1700 titles. On 378 densely printed pages Hattie discusses the factors which influence school learning more or less strongly and positively, the factors which are not relevant, and those which impede successful school learning. He also presents theoretical contexts and the practical consequences of his results. In the result of his analysis he distilled out 138 factors for successful school learning and shows their effect size. These 138 factors are arranged in six thematic groups: contributions to school learning from the student,

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The book reviewed here is Hattie, John A. C., *Visible Learning. A Synthesis of over 800 Meta-Analyses relating to Achievement* (London: Routledge; 2008), x + 378 pp., €97.99 (hbk), ISBN-13 978-0415476171, €33.50 (pbk), ISBN-13 978-0415476188.

the home, the school, the teacher, the curricula, and from teaching approaches. Independent from this grouping, he brings all 138 factors into a rank order: the strongest positive factors on top, weak influences in the middle, and some negative, impeding influences at the bottom. Hattie's book, he writes, is the result of 15 years of work. In November 2008 *The Times Educational Supplement* wrote: 'Hattie's aim to discover the most important fostering conditions for success in school learning could best be compared with the search for the "Holy Grail"'. The *Visible Learning Laboratories* at the University of Auckland, New Zealand (Director: John Hattie), rather immodestly point out on their homepage, that the search is complete now: Education professor delivers 'Holy Grail'.¹

To satisfy the curiosity of the reader right here at the outset: of the six *groups of factors* mentioned, 'teacher' has the strongest effects. The three strongest *single factors* are: (a) self-reported grades, (b) Piagetian programmes, and (c) providing formative evaluation. Very weak factors are e.g. (a) multi-grade/age classes, (b) student control over learning, and (c) open vs traditional teaching. The most negative and disabling factors are (a) retention, (b) television, and (c) familial mobility (relocation).

In the following I conduct a detailed analysis of the process and results of Hattie's analysis. However, this is not just a review of meta-analytical steps and the discussion of the stability and plausibility of the results obtained. Hattie has placed his analysis of the empirical research and data basis in theoretical contexts, we might say, in the context of a theory of teaching, a theory of student learning and of teachers' work in the classroom. This combination of an astoundingly broad empirical foundation and an inspiring theoretical contextualization makes the work of Hattie particularly interesting for the discussion of the relation between *empirical research* on teaching and schooling, on the one hand, and *theoretical debates* about the aims and qualities of the teaching-learning-process in schools, on the other.

Visible Learning has some limits and Hattie mentions that the book does not deal with circumstances in and out of the classrooms which cannot be influenced by the school. Qualitative studies are not considered, and methodological problems and debates are neglected. As the criterion for successful teaching and learning, only measurable student performance indicators are used, but Hattie admits that school education has to pursue broader goals. Finally, with meta-analyses it is only possible to look back; and in the future research evidence might change.

John Hattie worked for many years in several fields of empirical research on teaching and teachers, on diagnosis, evaluation, and feedback. For years he was engaged with the problem of summarizing and evaluating broad research programmes; for example, summarizing the research on the effects of feedback (Hattie and Timperley 2007). The Visible Learning Laboratories offer—against payment—a continuing education and training programme for teachers who want to develop their teaching. This programme includes the continuous testing and the feedback of results to students. Hattie is an important adviser to the New Zealand Government, where he currently articulates an increasingly critical attitude towards standards-based strategies of school reform. As a scientist and political adviser, he is quite controversial in New Zealand (Hammonds 2009a, b, Smythe 2010, Snook et al. 2010).

Method

Hattie's meta-meta-analysis (mega-analysis) does not summarize the results of research surveys in a 'literary' way, but refers to published meta-analyses and works out the statistical index for effect size. This statistical parameter provides—in addition to the information about statistical significance on a certain significance level—additional information: statistical significance indicates that a certain result has not come by chance. If the difference between the experimental and the control group at the level of $p < 0.05$ is (weakly) significant, this can be interpreted as follows: if one would undertake this analysis 100-times, in only five of these studies could the difference between experimental and control group be explained as random, but in 95 of these studies the difference would be systematic. There is an effect. How large this effect is and what it means in practical terms is not yet known.

The effect size d indicates the strength and, above all, the practical significance of a result. If a certain factor has an effect of $d = 1.0$ on student achievement, this means that due to this factor the average performance of the group increases by one standard deviation. If we introduce this factor (with $d = 1.0$) in a classroom, it means that those students who participate in this programme are, on average, above 84% of those students who do not participate in the programme. So an effect size of 1.0 is indeed a very strong effect. Hattie cites an example; Cohen (1988) uses: a human body size with an effect size of $d = 1.0$ indicates a difference between a person at 160 cm and another at 183 cm—a difference very visible to the naked eye. Needless to say, that effect sizes do not indicate causality!

Depending on data quality and data analysis, effect size can be calculated in very different ways. Concerning this problem and also concerning his mode of aggregating already aggregated effect size calculations (!) Hattie gives no detailed information, but presents only the simplest basic model of computing d : the difference between the means of two groups, divided by the pooled standard deviation (SD) of both groups. He illustrates this by the example of the effect of homework, which has an effect size of $d = 0.29$. Of the 161 research studies dealing with the effect of homework, 65% showed a positive effect of homework, while 35% showed a neutral or negative effect. The performance average of the classes with homework lies above 62% of the performance of students from classes who had no homework. Based on Cohen's analogy to body size, this means that $d = 0.29$ indicates an existing, but rather small difference in size between 180–182 cm. Were homework introduced in 100 classes, which so far had not been given homework, then one would find in only 21 of them an increased student performance (p. 9).

Hattie assesses an effect size of 0.2 as small, 0.4 as moderate, and d above 0.6 and greater as strong. His investigation of 138 factors resulted in effect sizes ranging from -0.61 (a very strong negative effect) to $+2.0$ and greater (an extremely strong positive effect). The vast majority of the documented effect size varies between 0.05–0.8. By the way, 95% of all effect sizes are positive. It seems that nearly all included factors have a positive effect, but to different degrees. About half of the 136 factors examined had an effect size of more than 0.4. Hattie fixes the threshold above which one can seriously regard a factor as recognizable at $d = 0.4$. This is the threshold

that must be exceeded. Above $d = 0.4$, we can speak of the apparent effect of a certain factor. For the *general* effect of education, school, classroom, and teachers' work have to be taken into account; certain particularly effective factors need to be above $d = 0.4$.

As mentioned, Hattie organizes the 136 factors into six groups: student, family, school, teachers, curricula, teaching approaches. Table 1 shows the pooled effect sizes of the six groups of factors.

The average effect size is 0.40; all factors lying above this limit are of particular interest. Out of the six groups of factors, 'teacher' has the strongest effect (0.49), 'school' (0.23) the weakest. Hattie concludes: If one takes two students of the same capacity, it is for their future learning less important which school they attend; the influence of teachers, curriculum, and teaching is stronger.

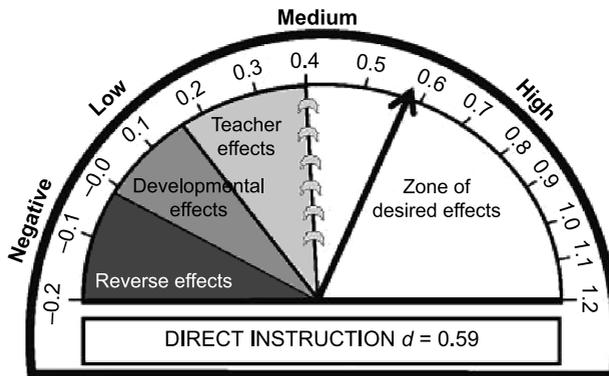
To visualize the effects and the relevant research background, Hattie uses the 'barometer of influence' (Figure 1).

For each of the 138 individual factors such a barometer is constructed together with a key to the corresponding data and characteristics. In the zone of the desired effects, that is, beyond a d of 0.40 we find those factors that have the strongest positive impact on student learning. In the zone between 0.15–0.40 we find typical teacher effects, i.e. the effects in this area are as large as those which typically teachers reach in a school year. The zone of effect size between 0.0–0.15 just indicates a learning progress which would also take place if students did not go to school (developmental effects).

Most of the meta-analyses Hattie uses stem from the 1980s and 1990s; a smaller part was published after 2000. The oldest is from 1980, the youngest from 2008. If we take into account that all these research studies summed up in a meta-analysis are ~ 5 years old, the greater part of the original data base probably is not current. This might explain why, for example, studies on the effects of content knowledge and pedagogical content knowledge of teachers have not yet been integrated. This also applies to studies on the effects of teacher education and its components. However, a certain connection between elements on teacher education, teacher performance, and learning outcomes from the viewpoint of the students of these teachers, at least in the field of mathematics education, is well documented.

Table 1. Average effects for each of the major contributions to learning (p. 18, shortened).

Contribution	No. of meta-analyses	No. of studies	People	No. of effects	d
Student	139	11 101	7 513 406	38 287	0.40
Home	36	2 211	11 672 658	5 182	0.31
School	101	4 150	4 416 898	13 348	0.23
Teacher	31	2 225	402 325	5 559	0.49
Curricula	144	7 102	6 899 428	29 220	0.45
Teaching	365	25 860	52 128 719	55 143	0.42
Total	816	52 649	83 033 433	146 626	—
Average	—	—	—	—	0.40



Key	
Standard error	0.096 (high)
Rank	26
Number of meta-analyses	4
Number of studies	304
Number of effects	597
Number of people	42.618

Figure 1. Barometer of influence: direct instruction.

It is striking that Hattie does not supply the reader with exact information on the issue of the quality standards he uses when he has to decide whether a certain research study meta-analysis is integrated into his meta-meta-analysis or not. Usually, the authors of meta-analyses devote much energy and effort to discussing this problem because the value or persuasiveness of the results obtained are dependent on the strictness of the eligibility criteria. Presumably, Hattie pulls up all the tangible meta-analyses, but each of them might and do have different strict eligibility criteria for the accompanying individual studies. In this way, the calculation of the pooled effect size of each of the 138 individual studies and meta-factors is of a very different quality, which can range from experimental studies to very well-kept, less controlled survey studies. The sheer scale and amount of the empirical basis is impressive, but the quality of the different zones of this data base is very heterogeneous.

Teaching

In the chapter entitled ‘The argument: visible teaching and visible learning’, Hattie outlines the consequences of his conception of teaching and learning. The overall message is: teaching is successful if teachers see learning through the eyes of pupils and students see themselves as their own teachers, or in Hattie’s words: ‘What is most important is that teaching is visible to the student, and that the learning is visible to the teacher. The more the student becomes the teacher and the more the teacher becomes the learner, then the

more successful are the outcomes' (p. 25). And, further, 'The model of visible teaching and learning combines, rather than contrasts, teacher-centred teaching and student-centred learning and knowing' (p. 26).

These sentences contain Hattie's theory of teaching. It includes both a theory of student learning and a theory of teacher behaviour in the classroom. *Seeing* plays an important role or, more accurately, the perspective or the taking of a certain perspective. For teachers and students it is important to overcome a self-centred perspective that only allows seeing oneself. Instead, teachers must be able to take the perspective of their students, and students need to see themselves as their own teacher. Stressing these specific kinds of 'seeing' explains the title of the book: *Visible Learning*.

Hattie's theory of school learning is, mediated through the work of Bereiter (2002), connected to Karl Popper's theory of the three worlds (or levels) of knowledge. Karl Popper has described the *physical things* as world one, our *subjective ideas* of all things as world two, and the third level of *objective knowledge* as world three. Hattie's informant, Bereiter (2002), uses Popper's model in an associative manner, and Hattie again uses Bereiter's arguments in unconventional ways. There is not enough space here to trace these things in detail. In a certain simplifying parallelization, Hattie uses Popper's model of the three worlds of knowledge to differentiate three levels (or qualities?) of school learning:

There needs to be a major shift ... from an over-reliance on surface information (the first world) and a misplaced assumption that the goal of education is deep understanding or development of thinking skills (the second world), towards a balance of surface and deep learning leading to students more successfully constructing defensible theories of knowing and reality (the third world). (p. 28)

In a simplified manner, Hattie speaks of *ideas, thinking, constructing* (p. 26). A dedicated didactic strategy to foster student thinking is rejected by Hattie. Instead of this, teaching has to connect itself to the already existing concepts and ideas of the students. Trying to develop students' thinking without relating to materially determinate problems, things, experiences, etc., 'would be like aerobic classes for Sherpa porters' (Bereiter 2002: 380f.).

The passages to the concept of learning, as well as to the qualities of school learning, using Bereiter's interpretation of Popper's epistemological ideas, move in a rather associative and stubborn way through the fields of learning theory. However, they can be related to elements of the German concept of *Bildung* which is not easy to translate or transform into English. *Bildung* is the process and result of education as *cultivation*; its highest level is *Selbstbildung* (self-cultivation). Hattie obviously develops a *formal* understanding of *Bildung*; the *material* side of *Bildung* as process and result, however, is neglected. Only in one sentence is a look at the material side thrown in: 'Educating is more than teaching people to think—it is also teaching people things that are worth learning' (p. 27). That might have been the starting point of a discourse about the *substance* of education and teaching, but Hattie does not follow this possible line of thought. So one wonders: Where is the beef? In the chapter on 'curriculum' one would expect more information about the substance, the content of school learning. However, again nothing can be

found there. The chapter is divided into specialized areas: reading, mathematics, and other curricular elements. Under these headings the reader again finds reports on certain specialized teaching *methods* and their effect sizes. The question of content, the question of the pedagogical significance of subjects, reflections about problems, and possibilities of legitimizing curricular decisions (Why include this—why exclude that?) are completely ignored.

On the basis of the analysed studies and in accordance with his theory of learning and teaching, Hattie draws a picture of active, responsible, both directive and—in certain situation—reserved, cautious. Hattie's ideal teacher is very well informed about the learning abilities of his students and is able to engage again and again in the task of supporting his students in their learning. For a teacher it is most important to integrate the students into content-oriented learning, trying, thinking, and judging, which, by the way, is not a fundamental new insight or discovery. However, the fact nevertheless remains that in too many lessons this currently does not happen! Hattie's ideal teacher can put himself in the position of his students and their learning tasks and learning difficulties, he can see through the eyes of the students. This teacher is interested in obtaining information about the students' learning and thus getting feedback concerning the results of his educational activities. The continuous monitoring of the effects of the teacher's own actions is the key condition for his/her successful didactic work. However, not only feedback from students to teachers is important. Also crucial is that a teacher gives feedback to his students and supports their learning, including the manner in which this is done.

This view of the dedicated teacher meets the model of the students who are able to monitor their own learning. This meta-cognitive perspective includes the perspective on their own learning, their own learning progress, their own learning difficulties and shortages. Both teachers and students must *see* learning; it must be *visible* to both. Learning in this context not only means the students' learning, but also the teacher's learning about the effects of his own actions.

Hattie explicitly turns against constructivist teaching:

Constructivism too often is seen in terms of student-centred inquiry learning, problem-based learning, and task-based learning, and common jargon words include “authentic”, “discovery”, and “intrinsically motivated learning”. The role of the constructivist teacher is claimed to be more of a facilitation to provide opportunities for individual students to acquire knowledge and construct meaning through their own activities, and through discussion, reflection and the sharing of ideas with other learners with minimal corrective intervention. (...) These kinds of statements are almost directly opposite to the successful recipe for teaching and learning as will be developed in the following chapters. (p. 26, for a critical discussion of constructivism in teaching cf. Terhart 2003)

Teacher

Of course, teachers matter! More precisely, only certain teachers with certain practices are highly effective. ‘What *good* teachers *do*, matters’ (p. 22).

However, not all teachers are experts, many are working at an average level, and some also below average. Teachers matter—in a positive *and* negative respect! This combination of negative and positive aspects is meant when researchers find out, that the factor ‘teachers’ explains a certain proportion of variance of the learning achievements of students (p. 108). A key to the effectiveness of a teacher seems to be the students’ assessment of his/her teaching (p. 34). Also, students esteem the quality high when a teacher is able to integrate them into the learning processes. Also important are the expectations of teachers related to the possible performance of their students, and their subjective theory of teaching, their understanding and beliefs about teaching and student learning.

Nye *et al.* (2004), in their meta-analysis, concluded that the factor ‘teacher’ (and this includes good, average, and poor teachers) explains 8–21% of the variance in the learning achievements of students. The corresponding effect size of $d = 0.32$ indicates that one standard deviation increase in teacher effectiveness should increase student achievement gains by about one-third of a standard deviation (p. 108). The teacher factor is stronger in the field of mathematics than for reading. For children in schools with low socio-economic status (SES) it is crucial for them to have a good teacher; for children with a higher SES, the quality of their teacher is not so important. Neither duration of experience as a teacher nor teacher education² explained much variance in teacher effects, and surprisingly the expertise in content knowledge also seems to be unimportant.³ The differences between regular qualified teachers and those with emergency, partial, etc. qualifications are not dramatic but show slight advantages for the regular qualified teachers. The rank order of contributions from the teacher is as shown in Table 2 (p. 109).

It is instructive to have a look at the specific model of teaching Hattie proposes as a result of his analysis. He distinguishes the *teacher as activator* from the *teacher as facilitator*, and his view of teaching as activating corresponds to his criticism of a constructionist orientation in teaching (Table 3).

The results show that active, guided instruction, which formulates clear requirements to the students and supplies them continuously with feedback about their progress and performance is more effective than unguided, facilitative, ‘helping’ teaching, which relies on inductive problem-solving processes and separate solutions etc. For Hattie, ‘constructivism is a form of knowledge, but not a form of teaching, and the construction of conceptual knowledge should not be confused with the current fad of constructivism’

Table 2. Contributions from the teacher: strongest effects.

1. Microteaching	0.88
2. Teacher clarity	0.75
3. Teacher–student relationship	0.72
4. Professional development	0.62
5. Not labelling students	0.61
6. Quality of teaching	0.44
7. Expectations	0.43

Table 3. Effect sizes for teacher as activator and teacher as facilitator.

Teacher as activator	<i>d</i>	Teacher as facilitator	<i>d</i>
Reciprocal teaching	0.74	Simulations and games	0.32
Feedback	0.72	Inquiry-based teaching	0.31
Teaching students self-verbalization	0.67	Smaller class sizes	0.21
		Individualized instruction	0.20
Meta-cognition strategies	0.67	Problem-based learning	0.15
Direct instruction	0.59	Different teaching for boys and girls	0.12
Mastery learning	0.57		
Goals—challenging	0.56	Web-based learning	0.09
Frequent effects of testing	0.46	Whole language—reading	0.06
Behavioural organizers	0.41	Inductive teaching	0.06
Average activator	0.60	Average facilitator	0.17

(p. 243). Learning is constructing corresponds a direct, active way of teaching. Construction fit with the teacher only in the following respect: he has to construct his own model of teaching and a model of the student's learning. From constructivism it does *not* follow that a teacher can withdraw from his role—the opposite is the case. According to this, Hattie points out the difference between the effects of teachers' activities level and the working conditions of teachers: The former have a *d* of 0.77, the working conditions a *d* of 0.08. Again this makes clear that the learning outcomes of students are heavily influenced by teachers' actions, whereas the working conditions of teachers do not exert any influence.

Discussion

Hattie's book is based on a monumental evaluation of two decades of empirical research on the conditions of successful school learning. Such a broad and comprehensive, synthesizing view of empirical research on schools, teachers and teaching is hitherto unique.⁴ The very broad perspective, his resolute manner of bundling results which have already been bundled, his calculation of (cumulative) effects (although not available in detail), his visually appealing way of presenting each effect size by 'barometers', his ability to synthesize broad quantitative information in a verbally convincing manner and to draw inspiring theoretical conclusions from the material—all make the book a veritable treasure for researchers since it presents and comments important information for those theoretically and practically interested in teaching, teachers, classrooms, and schools.

In this synthesizing power of the book also lies the reason for its weakness, since the focus on those factors in quantitative empirical research that are found to be effective for the measurable increase in learning achievement of students is combined with the exclusion of those factors that lead to other, broader, and also important effects of schools and teaching. Hattie's compilation of results only allows for those things that stand in the light of empirical research. This dilemma—that initially you might investigate places

where there is light, but the key may lie somewhere else still in the dark—is very clear to Hattie.

In one respect, the book offers no surprises: many of the most influential factors were already known as such. Time on task, however, comes only at rank 70 ($d = 0.38$), teacher effects (teacher effects) are at rank 85 ($d = 0.32$). Class size has only limited impact (rank 106, $d = 0.21$), ability grouping rank 121 ($d = 0.12$); teacher training rank 124 ($d = 0.11$).

A part of the criticism on Hattie condemns his close links to the New Zealand Government and is suspicious of his own economic interests in the spread of his assessment and training programme (asTTle).⁵ Similarly, he is accused of advertising elements of performance-related pay of teachers and he is being criticized for the use of asTTle as the administrative tool for scaling teacher performance. His neglect of social backgrounds, inequality, racism, etc., and issues of school structure is also held against him. This criticism is part of a negative attitude towards standards-based school reform in general.

However, there is also criticism concerning Hattie's conception of teaching and teachers. Hattie is accused of propagating a teacher-centred, highly directive form of classroom teaching, which is characterized essentially by constant performance assessments directed to the students and to teachers. This *Americanization* of the New Zealand classroom suppresses creativity of teachers and their new teaching methods, having been developed in a bottom up-manner in the practical field of teaching. So we are confronted with the entire repertoire of bottom-up school reformer arguments against—as they see it—a technocratic, administration-driven, centralistic, and economically motivated neo-liberal strategy of enhancing the efficiency of schools and teachers. This is a debate in schools, school administrations, and among experts of school research all over the world. In my view, all arguments have been exchanged and could only be repeated. However, I should like to point out one element: his interpretation of the broad empirical evidence on successful teaching and learning leads Hattie to a modernized and refined conception of authoritative, teacher-centred teaching. The teacher is in a position of dominance—but he has to tame or to hide his dominance in a student-centred manner. The traditional, overt form of governance and domination has changed to a refined, invisible, and modern one. This is obvious if we place it in the context of Foucault's thinking. Also, Hattie makes this very clear himself, as he places the mutual seeing, the mutual visibility, and the mutual being observed of the teacher's teaching and the learners's learning in the centre of his theory of teaching and learning. The symbol of this theory is the eye (p. 238) (Figure 2).

It is a certain blending of styles which is characteristic for Hattie's book. On the one hand, the book includes rather dry, almost mechanically written parts about the 138 factors of influence. It is indeed sometimes very hard and boring to go through the 138 factors successively. On the other hand, these passages, which are proportionally dominant, are fortunately stopped and surrounded by more literary, even emphatically optimistic framed parts about good teaching and—above all—about the characteristics of a good and effective teacher's work. In these parts, an overwhelming, exuberant optimism can be noticed, a deep (American? New Zealand?—or just pedagogical?) belief in the attainability of successful learning through good teaching.

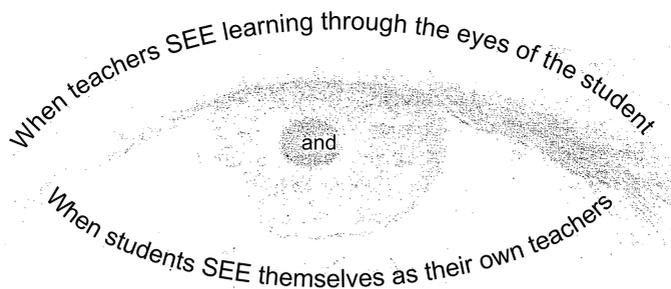


Figure 2. A model of visible teaching–visible learning.

This optimism leaves the reader—looking at the very often rather sceptical and pessimistic implications of the data he reports—a little bit perplexed. Of course, in cycles of teachers and educators we often come across the counter-piece to the well-known educational despondency: the pedagogical euphoria; this is a well-known phenomenon. In Hattie’s book this educational euphoria comes up in the form of a more psychologically well-founded belief in the infinite promotion of learning by right, the good teaching.⁶

The emphasis on the active, responsible sentient, continuously evaluating teacher leads to a modernized form of the romantic idea of the ideal, ‘born’ teacher. This modern idealism is based on the idea of scientific evidence and high educational spirit in the teacher choir. Secondly, it includes a rejection of a naïve-constructivist view of the teacher being nothing more than an observer of students rather than an activator for the students. This active challenging of the dominant role of the teacher is rehabilitated by Hattie. This teacher knows when to lead, when to speak—and he/she also knows when to withdraw and when to be silent. Hattie’s perspective on teaching is teacher-centred. However, in the centre of the teacher’s perspective stand the students. The teacher must be able to see their learning in order to adapt his/her teaching to it. Students in turn must learn to see their own learning and accompany it mentally; they have to regard themselves as their own teachers, while at the same time being observed and supported by their teacher.

Evidence-based education, evidence-based school management, evidence-based professional acting, etc.—are figures which seem to prevail in the course of modernizing government action, institutional control, and the professional actions of individuals and collectives all over the world. Evidence-based means that decisions and actions should be based on the best and broadest information base. However, what is a secure information base? Of course, it is a scientific one. This kind of knowledge is regarded as reliable, empirically and—at best—experimentally tested. Resources will only be devoted to strategies, etc. whose effectiveness has been experimentally proven. However, how can such science-based evidence be gained? How can the results of a great deal of research projects devoted to one problem be combined and cumulated in a controlled, objective manner? The development of research knowledge regularly leads to a steady win in

complexity and differentiation—and in most cases it does *not* lead to a single stable result. Meta-analyses are instruments that are able to squeeze results to a larger or lesser degree from complex fields of research on a certain topic.

What if there are already a number of meta-analyses in a certain field? Adding a new one would just be ‘more of the same’. A more appropriate strategy is to change the level, combine meta-analyses, and try to develop a meta-meta-analysis (mega-analysis). The scope of reference is thus indeed widened, but at the same time it is becoming even more complex, confusing, and full of inconsistencies. Moreover, much of the information from the original investigations is lost or distorted. Through repeated cumulation the original detailed empirical information disappears. Of course, it is possible to accumulate money using different channels and to bring different currencies together, but can you do the same with research results from different projects, different methods? And if you do so, is this still reliable—or is the robustness of evidence reduced the more you cumulate even more things that have already been cumulated on lower levels of analysis?

Regarding the stability of the results gained by mega-analysis, *Visible Learning* points to a dilemma: on the one hand, it can be expected that further research on very many of the factors on which Hattie reports will provide largely similar results. Almost all of the elements of effective teaching that Hattie lists are for about 10 years an integral part of the reviews and textbooks to good teaching. A future mega-analysis, presented in, let’s say 2020, and possibly including 300 additional meta-analyses, will probably provide little variation in this regard. How long does it make sense to continue this process? If it is continued, further efforts will just lead to an asymptotic approximation of already known results (stability hypothesis). On the other hand, Hattie’s mega-analysis on the impacts of teacher education and in particular on the impact of content-knowledge and pedagogical content knowledge in mathematics teacher education is already outdated. In the meantime, new and divergent research results on that topic have been published (variability hypothesis). Since his mega-analysis supports the stability and the variability hypotheses as well, it is obvious that Hattie in fact has not found the Holy Grail of research on schooling, teaching, and teachers. Instead of this he intensely labours on a very large pyramid, which on the one hand is firmly placed, already has a considerable width and height and a rather stable form. Of course it cannot be removed from its place. However, on the other hand, the pyramid is constantly restored in some parts and—above all—constantly extended in all its dimensions.

Notes

1. <http://www.visiblelearning.co.nz/asttle/pageloader.spx?page=1184d123d0d0> (accessed: 23 March 2010).
2. There are currently new studies and reviews devoted to the question of the identifying effects of teacher education that Hattie could not integrate into his book. These studies show that there are some effects of teacher education (Floden and Meniketti 2005; Kennedy 2008; Kennedy *et al.* 2008). For a discussion of the current state of research on teacher education as mirrored in three representative handbooks see Terhart (2009).

3. The project COACTIV (Baumert *et al.* 2010) has proved that the *content knowledge* of mathematic teachers and their *pedagogical content knowledge* together are important for the quality of their teaching. Higher levels of knowledge in both these fields lead to increased learning gains on the part of the students.
4. The classic works by Dunkin and Biddle (1974), Gage (1978), and Brophy (2000) are concentrated dominantly on teaching and not on its contexts.
5. ‘asTTle’ is the acronym for *Assessment Tool for Teaching and Learning* (http://tki.org.nz./r/asttleabout_e/php) (accessed: 8 April 2010)
6. In a current presentation Hattie indeed uses the concept of ‘total learning’ (Hattie 2010).

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