Effective schools: A causal analysis

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Effectiveness has always been an important and legitimate concern in schooling and education. Everybody wants school to have a good and desirable effect on the students, or else it would be downright unethical to keep them there year after year. The attention paid to effectiveness has waxed and waned, like with all educational topics and agendas, but these days effectiveness is at the center of much debate. This is largely due to the evidence-based practice (EBP) movement, also known as the *what works agenda.* EBP is strongly tied to political wishes concerning the improvement of school results, and thereby also to research into what works; i.e. into what to do to attain desirable goals. To say that something, e.g. a teaching method, *works*, is roughly to say that is has a desirable effect. If the effect is undesirable, we rather say that the method does *not* work, and if there is no detectable effect we likewise judge that the method does not work. Effectiveness is thus about to what degree something works; to what degree it contributes to goal attainment. If we have a high correlation between factual and desired outcome, we deem that the teaching is effective (and probably that the teacher is a good one).

The concept of EBP was created in the mid 1990s, and concerns the use of the best available evidence concerning 'what works' to achieve the goals given in the curriculum (or any other goal-directed professional activity, such as medicine). If we know which methods that work, we can *eo ipso* identify and discard those that do not work, and thus both improve effectiveness and make better use of the resources. Reading the vast EBP literature one might get the impression that this is a new invention, but that is far from being the case. It is noteworthy, though, that the EBP discussions and the current cries for knowledge that works do not look at earlier educational research, such as the effective schools research that began in the 1960s. It is my position that philosophical discussions often are or can be hindered by their neglect of actual empirical research, and I shall in this paper discuss (some of) the causal presuppositions of EBP by analyzing in some detail (some of) the research on effective schools, which claims to have identified factors that are essential to effective teaching. That is, I shall inquire into the relation between what goes in and what comes out, and I shall treat it as a causal relation. First I shall outline the formula for effective schools. Second, I shall

analyze the formula as a causal field, bringing a causal vocabulary to bear on certain select topics that arise: manipulation, causal order, necessity, sufficiency and probability. I shall defend causality in education, but also problematize the causal presuppositions made by the effective schools movement.

The effective schools formula

That which comes out is generally termed learning outcomes; sometimes learning results, learning effects, school results or achievements. *Output*, if you like. It has always been a central problem for education to find good, effective ways of achieving the desired learning results. Learning outcomes are at one end of a relation. At the other end is a wide range of factors we can call *input*. Whereas we can define outcomes reasonably precisely, it may be very difficult to say what the input consists in.

In the early 1980s 'effectiveness' was understood thus: "Effective schools are schools in which essentially all the students learn the objectives of the school program" (Brookover, 1987, p.225). The focus is on degree of goal attainment, which is determined by a comparison of desired and factual outcomes. *Input* is extremely diverse and can encompass anything from concrete content to larger factors such as teacher education, school architecture and access to computers. From the 1970s and onwards an array of inquiries were conducted aiming at identifying factors that are central to effectiveness. This research singled out certain factors that were found to be present in effective schools but not in ineffective schools (e.g. Edmonds & Frederiksen, 1978; Mackenzie, 1983; Stedman, 1987). These factors together constitute what Lawrence Stedman (1987, 1988) dubbed the "effective schools formula":

- School climate; a positive focus on learning, good order
- Educational leadership; a management that participates actively to create a climate conducive to learning and well-being in school
- High expectations on the students' achievements and attention; time-on-task
- Clearly expressed goals that are understood by all
- Assessment of achievements using standardized tests; monitoring of learning and progress

I would like to make a couple of initial observations about the formula. First, this set of factors belongs to the input-side; input being simply understood as factors that somehow are connected with the outcome. Concrete content is missing from the set – maybe we can say that the formula is the *how* and not the *what* of input. Second, the set is not complete. There

are researchers in this tradition who have basic skills training as a factor (e.g. Edmonds & Frederiksen, 1978; Eubanks & Levine, 1983). Third, the factors of the formula are not only large entities, but they are of very different kinds: climate, leadership, expectations, goals and assessment. Fourth, it should be noticed that these factors represent properties of an aggregate entity, namely the school, and as such say nothing specific about what goes on in the interactions between teacher, student and content. Finally, we should note that the formula is thought to be general and independent of context. This last point quite naturally leads to the idea that ineffective schools can adopt the formula and thus improve their effectiveness.

This research has been heavily criticized on many accounts; still Mackenzie (1983) in a review article comments that the agreement about the formula actually is quite widespread. It is not my business in this paper to worry about the empirical truth value of the formula; rather I am going to inquire into its causal presuppositions. To this end, the exact number of factors does not matter, nor which they are. The main thing is that they somehow contribute to the achievement of desired learning outcomes. The factors constitute what I shall call a causal field, a reasonably delineated domain where the factors depend on each other and influence each other in ways that can be studied. As we shall see, the internal relations of the factors as well as their (assumed) relation to the outcome can be manifold.

The formula as a causal field

Causality is underplayed in the effective schools research, also in the sense that the words 'causal' and 'cause' are not mentioned. There might be several reasons for this, among other things a deep skepticism toward causality in education, since it has been (still is, perhaps) associated with determinism, positivism and technical practice – all negatively charged words. On the other hand practical education employs a blatantly causal terminology, for example contribute to, lead to, influence, increase, bring about, reduce, hinder, prevention, intervention, learning effect, etc. All these are causal verbs and concepts pointing toward dynamic relationships where persons, intentions, tings, states of affairs, absences, events and actions influence and create changes in and for each other. Causality is thus a dynamic way of thinking that is evidently useful in education and all other professions that deal in *change*.

As a prelude let us look briefly at the effective schools terminology. The variables on the input-side are most often called *factors*, but also *characteristics* and *conditions* – never *causes*. The relation between input and output in described in different ways; I shall categorize them roughly. In one group we have e.g. *association*, *correlation*, *connection*.

These are in themselves non-causal, they describe co-variation and not causality. In the other group we have e.g. *improve, enable, affect, lead to, decrease, impact, promote, produce, work, facilitate, depend, reduce, manipulate*. These verbs are causal in nature; they depict some change being brought about. So even if the verb *to cause* is absent, we may safely conclude that we are dealing with an active causal vocabulary.

Causality as manipulation

There are several different theories of causality. The literature is vast and disagreement is the rule. As regards effective schools, we may at the outset ignore causal theories that understand causality in terms of continuous processes or interactions, since these demand physical contact. William Bickel describes one of the main ideas of effective schools as follows: "[T]hese successful schools exhibit characteristics that are correlated with their successes and lie within the domain of educators to manipulate" (1983, p.3). In passing, we may notice that 'correlate' and 'manipulate' do not sit well together, but that is not important. More importantly, we need here a causal theory that accommodates human actions as causes, and that brings us to manipulationist and interventionist theories. It is important to be clear that 'manipulate' here is a technical term; it simply means to change (the value of) input variables in order to change the output – there is nothing negative about it. To the contrary, this type of causal theory expresses a vital presupposition for educational activity: causal relations are usable in change-making. Such theories are therefore highly popular in disciplines that aim at bringing about change and development, as well as giving recommendations for actions or for policy (Woodward, 2008). On this theory, to say "x is the cause of y" is to say that if I intervene on x (input variable) and manipulate its value, this will lead to a change in y (output). This is a basic presupposition of both the effective schools movement and EBP.

Manipulationist theories capture various psychological insights we have about our own role in causal learning. We act, we intervene, we create changes and we observe the consequences and draw inferences about how things in the field in question hang together and what we should do to achieve the results we desire. I would like to make three points. First, the input variables have to be amenable to manipulation – and in this case they are. There is, however, a question as to *who* is in a position to manipulate them; that is, who is in control. While teachers (in my own country at least) have no influence on the objectives of the curriculum (since it is national), they can and do manipulate climate-variables. As can the students, by the way. Second, only *stable* relationships are manipulable. Relations that are random, elusive or extremely low-frequent are exploitable neither for planning, explanation

nor for predictable achievement of results. Generalization of the formula presupposes that the factors and their relations are stable. Third, actions and agency do not only involve manipulation, but also assume the ability to see how things could have been otherwise.

Causal relata and causal order

What kinds of entities can enter into causal relationships with each other? That is the question of causal relata. The standard view, according to Jonathan Schaffer (2007), is that causal relata are *events*, and that there are *two* of them, in the roles of *cause* and *effect*. This view is criticized by many causal theorists as an over-simplification. Other relata suggested are facts, properties, states of affairs, situations and – as mentioned above – actions. In our case climate, leadership, expectations, objectives, assessment and learning outcomes are proffered as causal relata; the former five as causes and the latter one as effect. It is not obvious which category the proposed causes fall under, and a causality purist might reject them as causal relata altogether. Causes must not only be manipulable, there must also be something about them that allows them to enter into a causal relationship with an effect. Nor is it obvious which category learning outcome falls under, but it is intuitively reasonable to think that it somehow depends on the input variables. And effects do depend on their causes, in varying ways and to varying degrees.

For the sake of the argument, let us assume that the five factors of the formula qualify as causes. How are they related internally? This is the question of causal order. This is a tricky problem that among other things points to the research design. Roughly speaking, the design is a comparison of contrastive schools; those deemed effective and those deemed ineffective, and an analysis of the differences between them. Rowan, Bossert and Dwyer comment that "The design has identified factors that covary with school effectiveness, but has provided little information about the causal relationships among variables" (1983, p.25). Lawrence Stedman is sharper and judges that the design invites "… simple, one-at-a-time comparisons, which do not indicate how variables work together to produce effectiveness or what their relative impact is" (1988, p.442). Rowan, Bossert and Dwyer correctly point out that causal order is important for any planning of change and improvement, and that a disorderly causal field creates problems for generalization and implementation. It may well be that the formula is empirically true, but that implementation of it fails to increase the effectiveness of a school because the causal order of the factors is ignored.

Let us play a little with the internal causal order of the formula. We may, for example, choose to see the factors as mutually independent, with an individual direct impact on

outcomes. Direct effects are effects that are not mediated by other variables in the causal field (Pearl, 2001). If this were the causal order of the field, implementation would be fairly straightforward – we can manipulate one variable at a time and the order is irrelevant. This may be what Stedman worries about. Judea Pearl, a highly influential causal theorist, argues that direct effects are invariant in relation to other relevant factors, since they represent stable causal relationships. This is an important point. Direct effects, invariant and stable relationships are (relatively) simple to manipulate. They are also autonomous, he insists, which means that if we intervene on one factor the others remain intact and unchanged. This is a good way of thinking if we want to predict the effects of our intervention, and that is something we often want. We simply hold the other factors constant and study one at a time.

It is, however, not likely that the causal field is organized like this, simply because education is such a complex activity. The critics of the effective schools movement all think that the factors are internally related, but they are rather silent as to how. I suggest it is reasonable to cast some of the factors in the role of *indirect* causes, which implies that there are mediating variables that modify the effect of x on y. Let us look at educational leadership. This is a factor one would not think has a direct effect on output. However, it is easy to envision that it has an effect on climate, which in turn has an effect on output. We may imagine that management has a direct effect on goals (assuming the educational system allows local goal formulations; or we may imagine that management has an effect on climate, which influences expectations, which directly influence output. In the latter case we have constructed a causal chain in which both climate and expectations function as both causes and effects. The more indirect a cause is – the more mediating variables that modify their effect – the harder it is to map its actual effect on the output. What does this causal order have to do with implementation? I guess that when Rowan, Bossert and Dwyer criticize the lack of causal order in connection with implementation, it is (at least partly) because they assume that causal order and temporal order coincide. Causes must come before their effects in time. If causes are mutually independent, the temporal aspect of implementation is of no significance and one can begin with either cause. But if causes are somehow inter-dependent, for example hang together in a causal chain, then time becomes an important factor to reckon with – one has to plan the order of the manipulation very carefully. If level of expectations is a mediating variable which depends on antecedent variables, it does not make sense to begin there in an effort to increase school effectiveness. This is generally considered to be a weakness of the research design; it offers no possibilities for describing the internal causal order of the formula.

As we have seen, the causal relations of the formula may be manifold. But the problems do not end there, and again the design is found inadequate. The schools that made up the sample were selected because they were already classified as effective or ineffective, on the basis of measured student achievements. This fact clouds the causal relation between cause and effect, again because causal and temporal order are understood to coincide. In effective schools the researchers found strong educational leadership. But what comes first? Does the management create an effective school, or is it rather that a principal is influenced by an already effective school and thus becomes an effective leader? The same problem is found in the relation between expectations and achievements. The effective schools movement (and many others) assumes that expectations come first and influence the achievements. But it could be the other way round. In that case, expectations are formed by the past achievements of the students. We also have a third possibility here, namely to see the expectation—achievement relationship as a two-way causal connection, where the two influence each other mutually and it in reality is impossible to say which is first and which is second. Both factors can easily assume both the role of cause and of effect.

I would like to raise one more issue in this section: the question whether the five factors are better understood as *enablers*, rather than direct and indirect causes. An enabler is a condition or a factor that makes *possible* various effects, but does not itself have to be a cause (Schaffer, 2007). One of the favorite examples in the causality literature is oxygen: the presence of oxygen is not the cause of fire, but a condition which makes it possible for a short circuit, say, to cause a fire. Oxygen is a necessary condition; without it, no fire.

Causality theorists disagree as to whether enablers are causes or "merely" conditions. I would opt for flexibility here and suggest that some enablers are causes and others not, and that one and the same factor can assume different roles in the causal field; as direct cause, indirect cause and enabler. It is reasonable, I argue; too view the formula as consisting of a set of enablers. If we look closely at the factors, none of them can be seen as direct causes of learning outcomes – Rowan, Bossert and Dwyer duly criticize the effective schools research for treating the classroom and the teacher-student interactions as black-boxes. It makes sense, though, to perceive the formula as making possible, supporting and facilitating a form of teaching that in turn has (desired) effects on actual learning outcome and thus makes the school (more) effective. In that case we ascribe a different causal role to the formula, and in consequence we need to take a new look at what sort of criticisms it is meaningful to make of it. For example, Stedman suggests drill and teaching to the test as alternative causes of increased effectiveness. But if the factors of the formula are perceived as enablers, they will

function as background conditions and will not compete with the alternative causes. They just play a different causal role – different, but still important.

Necessity and sufficiency

Viewed from a different perspective, Stedman's alternative causes indicate that the formula is not *necessary* for achievements – goals can be attained in more than one way. This is a frequently voiced criticism in the effective schools debate; there are several studies of schools where one or more of the factors are absent, but where the school is nevertheless deemed effective. When effectiveness can be obtained in other ways, the assumed cause is not necessary. Necessary factors are those that *must* be present for the effect to obtain; they are there as a "basis" that makes the effect possible – *conditio sine qua non*, conditions without which not.

It is not obvious to me just how damning the lack of causal necessity is; it need not imply that the formula is empirically false, just that unjustifiable claims are made for it and that there are other paths leading to the goal. It is more important for the effective schools movement to be able to say that the formula is causally *sufficient*; i.e. it produces the desired result when implemented. But, the critics claim, the formula is not sufficient either. This is shown by studies where the factors are all present, but where the school is nevertheless deemed ineffective. This is serious for the effective schools movement. A sufficient cause is a cause that brings about its effect unfailingly (it is invariant, as e.g. Pearl (2001) calls it). It seems to me that this is the understanding of causality that underlies the formula. The vocabulary reveals it: *will lead to, will promote change, will produce, will bring about*.

So while it is difficult to uphold the claim to causal sufficiency, it is also vital to do so, for several reasons. First, sufficiency is intimately connected to manipulation. It is the sufficient causes that can be manipulated to bring about a change in the output. Necessary causes do not produce the effect directly. They may of course be manipulable, but changing their value will not in and of itself produce a change in the output. Second, sufficient causes surely are also direct; their effect is not modified in more or less predictable ways by mediating causes. This makes them easier to handle. Third, causal sufficiency is also intimately connected to the possibility of generalization, since such connections are stable (invariant) and therefore transferable to different contexts. Those of the effective schools researchers who became "activists" and fashioned strong practical guidelines on the basis of their data (Mackenzie, 1983) must rely on these causal presuppositions.

Let me return to the issue of causal order and introduce the problem of causal selection. In educational contexts all causal fields must be assumed to be big and complex. Any event, any result, will have a large number of antecedents, so how do we select what we take to be central causes? Is there any objective basis for the differences between causes and background factors or enablers? There are two main answers to this question (Schaffer, 2007). The first is that there is no such basis. We cannot distinguish causes from conditions, and the choice of what is foregrounded as causes is random and subjective. Often we select that which stands out for us at the moment, or causes that we can ourselves can control, and the rest we relegate to the background. There may be some truth to this view; at any rate it has explanatory power: it could be that we select the causes of the formula because they are manipulable by the schools' adult actors – not the students.

The second answer is that our causal selections are too predictable to be completely without basis. This possible basis is explored in two main ways: in terms of necessity and sufficiency, and in terms of normal and deviant processes. Both approaches presuppose that we can distinguish between causes and conditions – there cannot be any concept of causality without such a distinction, the advocates argue (Schaffer, 2007). In our context here selection in terms of necessity and sufficiency is of the greatest interest. A *cause* is an antecedent situation or a change in it which is *sufficient* for bringing about the effect. This is important for the kind of manipulationist theory that we are dealing with here. We manipulate the causes and change them, and that is sufficient to produce the desired changes in output. Sufficiency, generality, stability, directness and predictability seem to be intimately connected. This, I believe, must be a fundamental assumption of the effective schools idea, but also for most, if not all, practical pedagogy and all other forms of intervention. It is hardly surprising that we select as causes the variables we ourselves can control, because that in turn gives some control over output – which is what we want. A *condition* is also an antecedent situation or a change in it, but it is "merely" necessary and not sufficient for the result. They may change without any accompanying change in output; on the other hand they are important because they make possible the operation of the sufficient causes. Some comments are in place. First, the problem of causal selection is a genuine and important problem, both in principle and practically. How do we distinguish between foreground and background? Is it random and interest-driven, or is there a more objective basis? Second, it seems obvious that the effective schools research has performed such a selection, albeit not explicitly. They have selected as foreground variables that are manipulable by certain actors and which are assumed to be sufficient to bring about the desired results. The sufficiency assumption brings with it

concomitant assumptions of generality and stability, which pave the way for predictability in goal attainment. Third, while this form of selection is reasonable and understandable, it is not without problems. I have argued above that while the effective schools advocates themselves believe the formula to be sufficient, it makes more sense to view is as a set of (possibly necessary) enablers, simply because they are too "far away" from output to function as direct, sufficient causes. Finally, it is important to point out that the fact that causal selection arises as a problem in itself tells us something about the causal field we find ourselves in: namely that it contains an abundance of differences, factors and possible combinations. Maybe it is only natural that there should be much disagreement as to what is the sensible selection and order of the concrete field.

Probability

Causality was for a long time a topic *non grata* in the natural sciences, after quantum mechanics demolished the foundation for the deterministic paradigm. In many ways causality is still a topic *non grata* in education and the in social/human sciences in general. However, from the mid 1900s causality has made a comeback in the natural sciences, for the reason that it is now mainly formulated in probabilistic terms. The causal theorists thus recognize that the world is contingent and that decisions are made under uncertainty, and that both can be represented and analyzed in terms of probability. This, of course, does not stop us from reasoning in terms of sufficiency ("if we do x, it will lead to y") when we plan how to attain a goal or in general reason about how things hang together in different contexts.

I have elsewhere argued that in educational contexts, causality is most sensibly thought of as probabilistic (Kvernbekk, 1997). The world is contingent and indeterministic and we cannot expect to find universal or absolute connections; especially not in complex situations and systems. The formula for effective schools is neither necessary nor sufficient for the desired output, as the critics point out, and some may judge this good reason to view the formula as falsified and reject it. But it may also be a reason to think of causality as probabilistic in nature.

In this way of thinking, to say that x is the cause of y is to say that x increases the probability of y. The probability of y given x is greater than the probability of just y. X is thus not a sufficient cause that always brings about its effect. Probabilistic theories are motivated by the idea that manipulating the cause *makes a difference* for the effect; hence, manipulationist and probabilistic theories are nicely compatible. This difference-making shows up in a probabilistic dependence between x and y (Williamson, 2009). The formula for

effective schools will, on this approach, not simply lead to improved effectiveness, but it may increase the probability for it.

Probabilistic theories of causality are compatible with indeterminism and allow us to make use of causal notions in a wide range of contexts where the factors are many and the connections are weak and/or difficult to grasp. These are good and important properties of probabilistic causality. On the other hand probability is a difficult concept to handle and there are (seemingly) no limits to how complicated and technically sophisticated probability theory can be. And disagreement among theorists is the rule, but that is as it should be.

We need first to distinguish between ontological and epistemic probability (Hájek, 2011). I think most people intuitively view probability as descriptive of the world, of how events and factors in the world actually hang together; that is, they interpret it ontologically. But a large family of probability theories is epistemic; it addresses subjective probabilities, degrees of belief, how strongly we do and should believe knowledge claims, and on what grounds. I shall side-step this theory, and I shall side-step all the well-known problems of probabilistic causality theory. Instead I shall briefly delineate three ways in which probability can be understood in the causal field in question.

First, there is what the literature calls *potential* causes; that is, causes that do not produce their effect every time, but rather frequently. In such cases we say that the cause has a *tendency* to bring about the effect, but it does not have to do it and hence we describe it as potential. Potential causes are like necessary causes in that they provide possibilities for the desired result to obtain, but unlike necessary causes potential causes do not have to be present – they are not necessary. They increase the probability of the effect; they make a difference for the occurrence of the effect. The concept of potential causes implies a distinction between causality at general and particular level. When we talk about tendencies and causal potential we move at a general level, since a cause that tends to bring about an effect does so independently of context. The formula for effective schools is presumed to be general. If we view it as a potential cause, we say it has a tendency to increase the effectiveness of schools, but that there is no guarantee that it will. We should note here that causality on this understanding is an objective relation; the formula is presumed to have general properties which sometimes bring about the desired result. Probability is thus understood as frequency.

Potential causes are causes that sometimes have an effect and other times not. A different way of understanding probability is to "grade" relata and relation and ask to *what degree* cause x produced effect y. This is a completely different question; it is not about

frequency but about the strength of the cause. Most causality theorists insist we keep these different questions strictly apart because they rest on different probabilistic assumptions and demand different probability measures (Galavotti, 2001). When we inquire into degrees of influence we often (but not necessarily) operate on a particular level; for example, we study to what degree the formula contributed to the increased effectiveness of school B.

A third way of interpreting probabilistic relationships is to think that one and the same cause can have different effects and assign a probability distribution for the possible outcomes. This might make it easier to spot potential (good or bad) side effects – a topic that seems largely neglected in the effective schools literature (and in the causal literature as well) but obviously is an important issue. Alternatively we might envision different and independent causes having the same effect. There can thus be several pathways to the same goal – an insight that is crucial in educational contexts. The more ways we have to reach a goal, the higher the probability that we actually reach it.

Some notes on implementation

One thing is to do research on what works, another thing is to implement it. Implementation is in itself a huge and complex topic, and I shall here only look at a few selected issues. What do we actually do when we manipulate variables like those we find in the effective schools formula, so that the probability of effective goal attainment increases?

Implementation of the formula is a kind of intervention, and interventions themselves stand in a causal relationship to that which is intervened on. We intervene and change the value of formula's variables, and this change has the potential to change the students' achievements (as measured on standardized tests) in the desired direction. But what do interventions involve? The most influential theorist in this area is Judea Pearl (2009). When we intervene on x, we change it completely or we assign a different value to it. That means that we so to speak cut x loose from its former causal history, in that *we* now decide its value, not its antecedents. We thus break off the old causal connection between x and y, and the old probabilistic dependence between x and y in the "undisturbed" causal field no longer obtains. We place the whole field on a different causal path because we want to change the values on the output variable, y. Pearl's model presupposes that all cause-effect connections are autonomous, which means that if you intervene on one of them the others remain unchanged. As mentioned above, this is a good way of thinking if you want to predict the effects of an intervention, but it is a presupposition that does not hold in educational contexts. All writers on effective schools claim that the factors hang together in complex ways.

The logic of intervention may sound deceptively simple. But let us look at manipulation of the variable 'high expectations'. The debate about effective schools has shown that this variable can be both cause and effect. As effect it reflects teachers' generalized experiences with students. Suppose that the teachers' expectations are moderate. How do we intervene on that? We cannot simply declare that the factor's value has been changed from moderate to high. This illustrates, I think, both the power and the problems of Pearl's conception of intervention. Interventions involve cutting a factor loose from its usual history and making its value dependent on the intervention. Expectations come from somewhere, they have a causal history, and an intervention means breaking the tie to this history. It is an open question how easy that is to accomplish – generalized expectations may be very hard to change, even if student behavior should change.

We also meet with other problems. Let us take a closer look at the factors we are meant to intervene on in order to create effective schools. They are all large categories and an intervention on them can conceivably be done in various ways (assuming, of course, that they belong to categories that admit of manipulation). Most philosophical theories of causality are contrastive, in the sense that they involve a contrast between what happens when the cause is present and what happens when it is absent (Hitchcock, 1996). This is naturally best tested if the factors are binary; that is, they are either "on" or "off", fully present or completely absent. If x is absent, the intervention may consist in establishing its presence in the causal field. If x's presence is the problem, the intervention may consist in removing it from the field. But the factors of the formula are not binary, they are rather graded (continuous) and an intervention on their value must be thought of differently. To what degree must the school climate conform to the descriptions of the formula to be causally relevant for the output? How does one intervene on climate? How do we measure whether x after the intervention has a value that can make a positive difference for output? All the factors of the formula are large entities that can be broken down into a range of smaller variables, which again can be intervened on. In turn this changes the basis for what kind of contrast we look at when we judge whether x makes a probabilistic difference for y. Our judgments become more nuanced and more complex. This is how Christopher Hitchcock concludes after having discussed how we can understand smoking and its causal relevance for lung cancer employing a graded concept of smoking:

> The solution to this puzzle is to deny that there is such a thing as *the* causal relevance of moderate smoking for lung cancer (even when background conditions are held fixed). Relative to heavy smoking, it is a negative cause of (prevents) lung cancer;

> relative to abstaining, moderate smoking is a positive cause of (causes) lung cancer (1996, p.402).

A causal field with many large factors can contain any number of contrasts of this type, and we have to think concretely about them when we decide on an intervention. Relations of positive and negative causal relevance hold only relative to specific alternatives, Hitchcock maintains. This is a question of degrees and not of binarity – *all* causal claims involve explicit or perhaps rather implicit contrasts with alternatives in this manner, he thinks.

Finally, there is the question of *ceteris paribus* conditions: the "all other things equal" clause. *Ceteris paribus* means that other possible variables in the field are ignored, or we assume that their influence is negligible. That one can do in research, but not in implementation. However, it seems that much implementation proceeds on the presupposition that there are no *disablers* in the context, i.e. no factors that somehow hinder or disturb the implementation so that the desired effects are not obtained as predicted or wished for. This I believe even if the literature points out that the formula is general and must be adapted to the school in question, because adaptation usually does not imply attention to possible disablers. How we should understand the results of an implementation thus becomes an interesting problem in its own right. For example, if researchers identify necessary causes and the practitioners interpret them as sufficient, then they will discover that the implementation does not yield the expected results. It is not necessarily the formula that is empirically wrong, but the understanding of what sort of causes one is dealing with that is inadequate. This is not uncommon, I think. It is further complicated if the relation between input and output is probabilistic and we have to think in terms of probabilities, frequencies, degrees and contrasts and worry about possible disablers to boot. That gives more relata, more nuances and a higher degree of complexity in the causal field.

Conclusion

Knowledge about what works is important in many professions as well as in daily life. This knowledge is causal; it is about the relationship between actions and consequences, between what goes in and what comes out. The formula for effective schools is an attempt to identify which factors are causally relevant for achieving desired outcomes in schools, in other words, to find out what works.

I have analyzed the formula using a selection of causal notions. It is important to say here that there are many more causal notions and theories that could have been employed; my analysis is far from exhaustive. I have, for example, left out regularity theories, counterfactual theories, absences as causes, and causal histories as ordinary (normal, expected) or deviant – all of which would be relevant for our understanding of the effective schools formula. Neither have I said anything about output, which in this connection is rather narrow and skills-oriented, beyond suggesting the importance of the idea that there are several pathways to the goal. I would like to point out, though, that the formula ignores the enormous plasticity of the human ability to learn, that which allows us learn even under sub-optimal or downright unconducive conditions.

The effectiveness researchers do not discuss causality explicitly, but they use a large causal vocabulary. I have argued that they perceive the formula as causally sufficient and general, and, hence, that it is based on stable causal connections in the field. These hang together, for only stable conditions are manipulable and can be used to create change and improve learning outcomes. Since the focus is on increasing school effectiveness, it is natural to select variables that can be controlled by the adult actors of the school – something that at least partly may explain why student effort is not represented in the formula. It is more reasonable, I have argued, to understand the factors as enablers rather than causally sufficient factors, simply because they are too far removed from the output to function as direct causes. If this is right, then the empirical truth value of the formula must be judged in a different way than earlier critics have done, for the reason that the formula plays a different causal role.

Finally it is important to say that all educational decisions and actions take place under uncertainty. We simply do not know all the relevant factors in a given context, and some of them may in principle be unknowable. This calls for humbleness both in our causal claims and in our implementations of those claims.

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