

Reproduction of social class in teacher education: The influence of scientific theories on future teachers' implicit beliefs

Anna-Carin Jonsson

School of Education and Behavioural Sciences, University of Borås, Sweden

Dennis Beach

School of Education and Behavioural Sciences, University of Borås, Sweden

Keywords: implicit theories, intelligence, pre-service teacher, scientific theory, education

Abstract

The aim of this article was to investigate the influence of a hegemonic class concept in teacher education, more specifically, the changes in the construction of implicit theories of intelligence within future teachers when they were exposed to the scientific g-factor theory of intelligence. A 2 x 2 ANOVA (first versus last semester at the teacher education) x (experimental versus control condition) was used on 102 student teachers who had been exposed to a short vignette of the g-factor theory. Implicit theories of intelligence as fixed and innate were significantly stronger when exposed to this theory. This result was confirmed in a second study with 177 student teachers. Two 2 x 2 (fixed versus incremental) x (experimental versus control condition) ANOVAs in both mathematics and social science were conducted. When exposed to g-factor theory (experimental condition) the fixed theories increased and the incremental theories decreased in relation to both mathematics and social science.

Reproduction of social class in teacher education: The influence of scientific theories on future teachers' implicit beliefs

The concept of intelligence is rooted in entrenched *cultural models* and has significant effects on individuals through their *implicit theories* about themselves, others and the world (Kunda, 1999; Malle, 2004). When regarding the concept of intelligence, one notion is that children at school learn about intelligence as a way of determining who will be fit for intellectual labour in contrast to those who won't (Beach, 1999, 2001). These sorting processes seem to be systematically related to social class (Ostrove & Cole, 2003; Beach & Dovemark, 2009). As Parker (2007) states, capitalist society is still (globally) dependent on an economic underclass for symbolic and economic exploitation. Moreover, this underclass still comprises the majority of the global population and schools are significant institutions in relation to the discursive construction, ideological justification, normalisation and social reproduction of this class (Beach & Dovemark, 2005, 2007, 2009)¹. This applies even in a society like Sweden, which presents itself to others and even to itself as middle class, as if the under-class of workers were just an unfortunate minority. There is a contradiction between the image of a middle class society for everyone, in the current Swedish conception of it, and the reality of a working class society without stable work for many people who are then also forced to live out naïve beliefs about what is wrong with them. Teachers and schools play an important role as the makers and mediators of judgments about intellectual achievement.

According to Ahmavaara and Houston (2007), Gould (1996) and Pramling and Säljö (2007) these judgements rest on a foundation of specific scientific theories of intelligence such as for example Spearman's (1904) scientific theory of intelligence, the two-factor theory or the more recent *Cattell-Horn-Carroll (CHC) theory*, one of several variants of g-factor theory (Ackerman & Lohman, 2006 and for an elaborated discussion of the two-factor/one-factor model see for

¹ The school as an institution plays an important role today in the constitution of this class. First in a selection process by means of which the people that make it up are judged as incapable of intellectual achievement and categorised to perform manual labour in a majority middle class society. Secondly through the projection of a dominant ideology about how the differences that are seen can be made sense of and understood in a manner that does not destabilise the foundations for the existing social order. The role of the school in the creation, justification and reproduction of social class involves, indeed relies upon, teachers acting as intermediaries and mediators of distinct social values that are communicated to pupils, about life, learning, knowledge, intelligence, themselves and their abilities and capabilities (Beach, 1999, 2001; Beach & Dovemark, 2005).

example Sternberg, 2004). These theories are important in that they explicitly state that intelligence is naturally inborn and in essence a more or less unchangeable entity that you either have or do not have. They make the assumption of a natural ability amongst children as something that is understood as fixed, unevenly distributed among the population, difficult in itself to influence and continually operational in classrooms as the key factor that lies behind differential and differentiating educational performances in schools today (Beach, 1999, 2001, 2003). This way of sorting children in school forces each child to live its failures ‘as something from which they are alienated’, as something ‘deep within themselves’ and as something which they can neither comprehend nor escape from (Parker, 2007, p. 3).

Investigation Aims

The present investigation aims to explore the influence of scientific theories of intelligence on the everyday, implicit theories of intelligence held by teachers: that is, on the operating concepts of intelligence those teachers apply in their everyday work and by which they judge the behaviour and performances of their students. It does this by examining these issues in respect of future teachers on a pre-service teacher educational program. Three initial statements are important. First, the meaning attached to the concept of intelligence seems to influence strategy choice in learning situations with consequences for performances and achievements (Beach, 2003; Dweck, 2007). Second, constructions of intelligence are socially interactive and significantly influenced by teachers in school (see e.g. Leroy, Bressoux, Sarrazin, & Trouilloud, 2007). Third, learning is undermined for a broad reach of the pupil population when a view of intelligence as a fixed entity is adopted in contrast to when an incremental view of intelligence as malleable is promoted (Hong, Chiu, Dweck, Lin, & Wan, 1999; Ommundsen, 2003). The entity view (the implicit theory that intelligence is fixed and inborn) correlates with less effective ways to think about the ability to learn and may influence behaviour in learning situations in a counter-productive way. These things make the formation of implicit theories of intelligence extremely important to understand. These theories exert influence over future evaluations and judgments at work and they may actually also help to conserve a liberalist ideological view of capitalist society as a natural hierarchy into the next generation.

The above points help to introduce our specific aim with the present article, which is to present

the outcomes of an investigation into what we define as a *transportation area of ideology* of the hegemonic middle class and how this helps conserve beliefs that intelligence is inborn and unchangeable. With transportation area we mean *a specific place in time where influence is conducted in a systematic manner*. The transportation area we are investigating is the specific content of the popular scientific literature presented at many teacher educational programs in Sweden. However, *a transportation area of ideology* could be any classroom, work-place or TV-program where a structured message is transported from those in control over the communication to those receiving it.

We have conducted the investigation within teacher educational programs. We aim to show how future teachers may become convinced that intelligence is an entity that can be used as a tool to categorize people as fit for intellectual or manual labour. Moreover, we will also test hypotheses about how certain scientific theories of intelligence may increase certain implicit theories and beliefs among the pre-service teachers and decrease others. In this way we can therefore begin to identify which kinds of theory that may have a destabilising function in relation to the hegemonic position. We do this from a Marxist materialist position of cultural historical psychology.

Marxist Psychology Theory and Method

The point of departure of Marxist psychology is in dialectic theory and the idea expressed by Marx concerning the role of history and the environment on the development of human consciousness, ideas and activities in the Brumaire. That is, that man (sic) is the maker of his own history but not under circumstances which he alone has chosen, rather under circumstances and conditions inherited from the past and that can weigh like a nightmare on particular aspirations and understandings².

This point of departure has to be mentioned because of the persistent efforts of mainstream positions in psychology to oppose the individual to society rather than to see him or her as inseparable from it. The received view in mainstream psychology is that society provides only an

² Marx wrote the Brumaire under the title *The Eighteenth Brumaire of Louis Napoleon*, in reference to the first day of Napoleon Bonaparte's dictatorship by a coup d'etat. In it he traces the contradictory relationships between the outer form of a struggle and its real social content and how the conflict of different social interests manifest themselves in the complex web of political struggles.

external environment to which people adapt in order to survive. But what is ignored here is that society consists not only of external conditions to which one must adapt but also conditions that culturally, materially and historically mediate the motives and aims of activity itself and the ways and means of realization of that activity. In other words, to paraphrase Vygotsky, society *produces* human activity with/in mutually conditioning relationships between base and superstructure as in respect of human behaviour, human understanding and human self-understanding (also Mather, 2003; Parker, 2007). The economic base exerts a primary causal influence but does not rule out autonomous creativity in relation to that activity (Althusser, 1969). This is why what kind of scientific theory of intelligence that is taught at the teacher educational program is important as it is here that a hegemonic ideology may be nourished.

Another important area of Marxist psychology is to use any methodological tool needed for its task and not to abandon methods of for example quantitative research on the basis of unwarranted assumptions and lack of knowledge (Jost & Jost, 2007). The aim is to investigate the characteristics of every specific transportation area of ideology in a systematic way and separate what Cook and Campbell, in their classical work on quasi-experimental design, named ‘molar causal laws (laws stated in conditions of large and complex objects) from micro-mediation that refers to the specification of causal connections at a level of smaller particles than make up the molar objects’ (Cook & Campbell, 1979, p. 32). In general, the molar laws consist of many micro-mediated causal connections. Marxist psychology could contribute to Marxist theory by investigating the micro-mediated causal connections by experimental and quasi-experimental design which is well developed within psychology. In this way, Marxist psychology can explain exactly where a specific causation of an event (micro-mediation) on a specific level of practice is completed and relates this to the larger molar laws that constitute Marxist theory itself.

Marxism is often dismissed by its critics as economically deterministic. However, the problem with determinism can be handled by considering the concept of time from a dialectic point of view in relation to the thesis – antithesis –synthesis theory that Marx incorporated from Hegel (Ritzer, 2008). In this process of mediation the first cause is 1) base influences superstructure and the next cause is 2) the changed superstructure changes base. However what is important not to forget here is that these events are separated in time; where the first was first and the second

came after the first: put simply and concretely, the neo-liberal orders of production and reproduction exist as material practices and global ideology before neo-liberal governmentality is incorporated in the minds of citizen-subjects, including pre-service teachers.

It is important to take in consideration that Marx abandoned speculative philosophy in favour of a search for empirically grounded forms of investigations that resemble those of today's mainstream sociology and psychology (Jost & Jost, 2007). Marx's goal to reach an improved society went through revolutionary activity and the empirically grounded scientific understanding of, for example, human needs and capacities. Cohen (2000), in the tradition of Analytic Marxism strongly argues that Marx theory is falsifiable and empirically testable contrary to Popper's (1971) statement that it is not. Jost and Jost (2007) shows that conclusions from Adorno concerning the "authoritarian syndrome, the rigidity of right-wing ideologues and the link between conservatism and prejudice have in fact been sustained by subsequent research in psychology" (p. 314). This third way, to not abandon the hammer as a tool because it has been used by a neo-liberal researcher, but instead use the relevant methodological tools necessary to each specific question is how we approach our research questions and methodological choices.

In the present article we focus on one specific transportation area of ideology where the influence of the hegemonic class on superstructure is accomplished. The area is the area of initial teacher education. Here future teachers take part in meaning making processes within the specific social and cultural practices at teacher educational programs that are struggling between competing regimes of truth (Bernstein, 2000). However, these competing regimes of truth do not compete on neutral and equal terms (Beach, 1995, 2000). The hegemonic domination of the ruling class, which is manifested in ways like the division between manual labour and intellectual labour today legitimizes some regimes of truth - such as intelligence as an inborn entity that some have and some don't and that is not easy to do anything about - and not others, such as intelligence as changeable and relative (Parker, 2007). To be able to deal with this a third way for Marxist psychology is needed leaving the poor data and sexist theories of people like Spearman, Freud and Gardner behind.

Study 1

In teacher education future teachers are exposed to various scientific theories of intelligence. One of these is Spearman's (1904) scientific theory of intelligence. Spearman's basic assumption is part of the currently most widely accepted theory of intelligence. This theory postulates the existence of general intelligence. However, there is a debate concerning if there are two-factors at the top represented by fluid and crystallized intelligence or if these two also load onto a general factor alone at the very top of the pyramid or not (see for example Gustafsson, 1984 or Sternberg, 2004). This one *super-factor* is supposed to underlay all types of mental processing (Demetriou & Papadopoulos, 2004) and it represents intelligence as an innate individual property inside the individual. This theory is often taken for granted and absorbed in everyday practices of teaching and through this intelligence and achievement is associated with the internal properties of brains, minds and people (Plaut & Markus, 2005). This applies despite the fact that research has several times shown the devastating consequences on motivation, achievement and grades that takes place if and when the naïve belief in intelligence is conceptualized as fixed and innate (Dweck, 1999, 2007).

In order to investigate the possible effects of teaching about intelligence in teacher education we composed a quasi-experimental study involving two groups of future teachers at a teacher educational program in Sweden. One of the groups was an experimental group. In the experiment, which took place inside their normal timetable in an education studies course, they were presented with a short summary of the g-factor theory and were told that they were to receive questions about it later. The other group was a control group. The control group was confronted with the same questions as the experimental group at the same time, but they had not been exposed to the g-factor theory before this confrontation. In the questions that were given to participants they were asked to make responses of agreement or disagreement concerning (a) certain types of implicit theories of intelligence and (b) how credible they found different scientific theories of intelligence to be.

Our approach is in line with the method used by Bargh and Ferguson (2000) and Chartrand and Bargh (1996) in their studies of priming. The common definition of priming is "*The process of activating knowledge or goals, of making them ready for use*" (p. 67, Kenrick, Neuberg & Cialdini, 2005)

Earlier research using the priming approach primed one concept with another. Today there seems to be a growing body of evidence in favor of the priming of conceptual structures –i.e. constellations of thematically related sets of effects (for example cultural ideologies) - and not single concepts as before (Bargh, 2006). More specifically, one concept does not influence another isolated concept; instead it can influence a net of interrelated concepts of both perceptual and actionably nature. The theoretical base of predicting such effects is the overlap between perceptual and actionable representations for the same type of behavior (Bargh, Gollwitzer, Lee-Chai, Barndollar & Trötschel, 2001). This could explain why teachers who believe intelligence to be fixed will also behave in a specific way whilst those believing in intelligence as malleable behave in another without any conscious acts of will or specific guidance (Butler, 2000).

It is, however, not only the automatic, unconscious processes that are seen as determined (Bargh & Ferguson, 2000). That a person exerts volition during controlled processing does not necessarily mean that the behavior is intentional and can be taken as an evidence of the free will rather than determined by situational features. To treat someone fairly (as a teacher might a pupil) is thus an executive process that operates on information held in working memory which, although this could be seen as something within the person's control, is itself being *controlled by determined, automatically operating goal structures* such as ideologies and implicit theories (Bargh and Ferguson, 2000, p. 939).

These automatically operating goal structures are of great interest for a Marxist psychological theory in that they can be part of the explanation of the concept of alienation (Mészáros, 1975). The goal structures are not necessarily our own. It is the capitalist society's goal structures we accomplish instead of our own perceptualized and actualized goals that, if they were fully lived, would stimulate human creativity.

We are approaching Bourdieu's (1999) concept of habitus here. As Bourdieu (1960) wrote in *Algeria*, an active subject does not meet society as if it was an externally constituted object. Rather, the source of action resides 'neither in consciousness nor in things but in the relationship

between two stages of the social, that is, between the history objectified in things, in the form of institutions, and in the history incarnated in bodies, in the form of that system of enduring dispositions which I call habitus.’ (p. 53).

Habitus is thus an instrument of mediation that engenders perceptions, expressions and actions within the limits imposed by the historically and socially situated conditions of its production and can be explained as a way of being that develops in automatic association with the features of the situations in which ideas and representations have been repeatedly and consistently activated and pursued. These representations can become activated without any conscious will and subsequent behavior is then guided by them within the situational context faced by the individual (Bargh et al., 2001).

This idea could also explain the process of *false consciousness* as the holding of false ‘beliefs that are contrary to one’s social interest and which thereby contribute to the disadvantaged position of the self or the group’ (Jost, 1995, p. 397). If knowledge is constructed by prior beliefs and experiences, then the scientific theories of intelligence on teacher education contributes to these representations of implicit theories of intelligence and can be activated unconsciously by situational features and unconscious automatic actions based on conceptual structures. The hegemonic class has a strong interest in keeping the idea of intelligence as inborn and unchangeable intact in that it nicely legitimates the categorization of people and attributes the subordination (including usually the lower payment) of manual labor compared to intellectual as it is presented and understood as being of inferior intellectual ability.

Scientific Theories of Intelligence

Future teachers (and teachers) are exposed to scientific theories in their socio-cultural context in their education and their profession. This can, we feel, be highly problematic for the educational attainment of many pupils if theories that promote intelligence as fixed and innate are adopted to a higher extent than are theories that treat and present intelligence in other ways, such as for instance malleable and contextual (Dweck, 1999).

Examples of *fixed theories* are those reproduced by researchers like Deary, Strand, Smith and

Fernandes (2007), who with results from 70 000 English children showed a correlation of 0.81 between cognitive ability tested at age 11 and school achievement at age 16. They claimed that 50%-60% of the variance in achievement can be explained by the prior factor *g* with a strong genetic correlation between cognitive ability and educational achievement and deny the influence of socioeconomic conditions. The 70 000 children's teachers as well as their parents and the children themselves are exposed to this scientific "truth" – 'Deary et als.' account is resonant with dominant assumptions and common social practices (Ahmavaara & Houston, 2007). As Ahmavaara and Houston express it, in society today naive theories of intelligence as innate and fixed (entity theories of intelligence) is the most popular explanation of intelligence³.

In the *Handbook of Educational Psychology* edited by Alexander and Winnie (2006), a book that is commonly used and referred to in teacher education contexts, three theoretical models of intelligence are presented. However, only one of them has convincing empirical evidence according to Ackerman and Lohman (2006). The models are the *Cattell-Horn-Carroll (CHC) theory* (one of several variants of *g*-factor theory) that does have empirically acceptable evidence, *Gardner's Theory of Multiple Intelligences* (which is said in the handbook to have a definite lack of empirical data) and *Sternberg's Triarchic Theory of Intelligence* (that also, it is said, lacks convincing and thorough empirical studies). In this way a one-dimension all ruling perspective is actualized and future teachers become exposed to a dominant habitué belief in intelligence as innate and fixed.

One exception to the vast majority of theories that posit that intelligence is internal is the Soviet sociocultural paradigm (Grigorenko, 2004) from Vygotsky. However the Sociocultural theory is presented as a developmental theory or perspective in the teacher education literature and not as a hard scientific theory in competition with the *g*-factor theory (see for example Eggen & Kauchak, 2003; Lundgren, Säljö & Liberg, 2010).

³ In accordance with this Plaut and Markus (2005) reviewed a number of studies of intelligence in the western world and contrasted them to the situated locus of intelligence as it is represented in collectivistic cultures. They concluded that the empirical evidence for the *g*-factor theory is far from convincing and that the research supporting it fits the predominate cultural model of behavior; including the assumptions of the ancient Greek concept of essentialism, a Protestant ethic and Locke's liberal individualism. Pramling and Säljö (2007) in their research on metaphors of intelligence state that modern genetics plays a central role in developing social awareness and communication about intelligence. The question is if there is one single truth about intelligence as innate and fixed or a multiple approach of explanations of intelligence as changeable that is communicated in society through modern genetics.

G-factor, Multiple, Triarchic and Socio-cultural theories of intelligence are often encountered in teacher education in Sweden (see e.g. Lundgren et al, 2010) and much of the rest of Europe according to a recently completed EU sixth framework project (www.profknow.org) and in a global literature review of research on the education, development and work of professional teachers (Goodson & Norrie 2005). Marxist theories are not usually encountered. According to Marx, human nature is the totality of the circumstances in society. Human nature varies dependent on different conditions through time and culture Marx (1945/2003). The present article aims to discuss the credibility of different theories as expressed by pre-service student teachers.

Implicit Theories of Intelligence

The focus for research within implicit theories of intelligence is not on what intelligence is or is not. Instead it is important to grasp an understanding of what meaning people attach to the concept of intelligence. According to Sternberg (1985), implicit theories of intelligence are important in that that these theories direct behavior and the use of intellectual abilities because they specify what is and what is not acceptable in a particular cultural environment. In other words, they shape cognition, understanding and problem solving.

Dweck (1986; 1999) and Dweck and Legget (1988) claim from several empirical studies that implicit theories of intelligence (also called naïve or lay theories) play an important part in learning and achievement situations. People seem to conform to either an entity theory where intelligence is seen as a fixed trait and unchangeable entities and therefore uncontrollable or an incremental theory where intelligence is seen as malleable and changeable and therefore controllable. It is suggested that as early as kindergarten children identify with one or the other of the two views, with serious implications for their motivation and achievement level (Bråten & Stromso, 2006; Dupeyrat & Mariné, 2005), intelligence and personality (Furnham, Chamorro-Premuzic, & McDougall, 2003) and development (Gonida, Kiosseoglou, & Leondari, 2006; Leondari & Gialamas, 2002).

Spinath, Spinath, Riemann, & Angleitner (2003) investigated the relation between implicit theories of intelligence and personality in relation to measured intelligence and personality

(intelligence measures were developed from g-factor theory). One of their hypotheses was that ‘more intelligent individuals might define intelligence more in line with the scientific definition (as a relatively stable trait underlying learning and achievement)’ (p. 942). They did not find any relation for personality but nevertheless concluded that ‘highly intelligent individuals perceived intelligence as more stable compared to less intelligent individuals’ (p. 949)⁴. This is a comfortable explanation for the hegemonic class. Through it those that question the inborn qualities in the concept of intelligence are simply too stupid to understand the greatness of these inborn qualities.

Research Questions

If scientific theories of intelligence have an impact on the implicit or naïve theories of intelligence among the future teachers, a hegemonic goal structure can be incorporated that teaches the teacher students to categorize people in terms of their suitability or not for intellectual labour (Marx, 1945/2003). More specifically, it could be that an entity theory of intelligence is promoted in an indirect relation through the scientific theories presented to the students that stimulates an individualistic, neo-liberal capitalistic view where some are judged incapable of intellectual labour on the false grounds of the within-individual variable of general intelligence (g). This is highly problematic if teacher education is aiming to accomplish a democratic learning environment. As we discussed earlier, representations (of for example implicit theories of intelligence) develop in automatic associations with situations (Bargh & Ferguson, 2000) through an overlap between perception and action (Bargh et al., 2001) and encourage future teachers to act on implicit beliefs that may be triggered unconsciously (Bargh, 2006). The question is; what should we teach the future teachers, which theories should we confront them with and what effect will these scientific theories have on their representations of intelligence?

Pajares (1992) suggested in his review concerning student teachers’ beliefs that they are often well established by the time these teachers start their educational programs and may form *tacit beliefs* from previous experiences and the prevailing culture that are hard to change (Calderhead,

⁴ In Spinath et al’s study, those who received higher IQ-scores also believed to a higher degree that intelligence was fixed and innate. Based on this Spinath et al. came to the unwarranted conclusion that the causal relationship somehow goes from the IQ-score to the belief and that the highly intelligent individuals have a great potential to understand that the true theory is that of intelligence as fixed and innate whilst those who are not as intelligent do not have the potential to understand this.

1996; Massengill, Mahlios, & Barry, 2005; Murray, Nuttall & Mitchell, 2008). However, Blackwell, Trzesniewski, and Dweck (2007) used scientific theories in support of an incremental theory of intelligence in order to change these tacit, implicit theories in favour of a malleable view of intelligence and succeeded.

This discovery leads to our *first research question*, which concerns if implicit theories are influenced by the presentation of scientific theories of intelligence. Here we hypothesize that the entity theories of intelligence should become stronger when exposed to the g-factor theory and that the incremental theories of intelligence should become weaker. This result would confirm Blackwell et al's findings (2007).

The second research question concerns if teacher education has an effect on the implicit theories of intelligence among the future teachers. According to Pajares (1992) there should not be any significant differences in tacit/implicit theories between future teachers on their first and last semester. We want to see if this is actually the case.

The third research question is related to this. It deals with the impact of the g-factor theory on the credibility future teachers attach to this and three other scientific theories; Sternberg's Triarchic Theory of Intelligence, Gardner's Multiple Theory of Intelligences and the Sociocultural Theory of Intelligence (Ackerman and Lohman, 2006; Sternberg, 2004). We expect the credibility the future teachers have for the Triarchic and Sociocultural Theory of Intelligence to decrease when exposed to g-factor theory initially (even if it is only a short summary and they are only asked to read it in order to be able to answer questions later on it). This because the core message in g-factor theory differs significantly from these two theories. However, we expect the credibility attached to g-factor theory itself and Multiple Theory to increase in that the core messages are very close and almost overlapping.

Method

In the past ten years and up until the 2011 intake teacher education in Sweden has been of a three-and-a half or four-and-a-half year duration (depending on specialisation) and has included the equivalent of one and a half years of full-time study in what is called

the common (professional) education area for all future teachers. This content is presented in three equally sized study units, one at the start of the teacher program, one in the middle of the programme and one at the end before the final exam. Between three and four years of study separate the first and final semester, depending on the student's subject combinations and age-range focus. It is important to make clear that the content within the common educational area is not exactly the same but differs, although not massively, according choices and preferences at different institutions.

Participants

102 future teachers on an initial teacher educational program participated. Their ages ranged between 19 and 48 years (mean 26). There were 89 women and 12 men. They were enrolled on preschool (63 students), elementary (28 students) and secondary (10 students) programmes. The gender distribution is heavily influenced by sample emphases on early-years teacher education programmes and is nationally representative.

Measures

A Swedish version of Dweck's (1999) *Theories of Intelligence Scale* (TIS) was used to assess the teachers' entity and incremental theories of intelligence by. The full version of the instrument was administered including four items measuring an entity theory of intelligence as a fixed trait and uncontrollable (sample item: Your intelligence is something about you that you can't change very much) and four items measuring an incremental theory of intelligence as something malleable and controllable (sample item: You can always substantially change how intelligent you are.). The concept *Other* was applied to the scale, as Dweck (1999) suggest, to allow us to focus on the future teachers' beliefs about the intelligence of others rather than their own intelligence.

It is important that the measures used are reliable. Because of this a Cronbach's alpha was performed where an alpha value of 0.700 or above was considered acceptable. For entity theory of intelligence the scale received an alpha value of .730 and the incremental theory of intelligence scale received an alpha value of .848. From this we can conclude that the items used to measure implicit theories of intelligence were

reliable. A 10-point clear numerical scale was used ranging from 1 = strongly disagree to 10 = strongly agree with the statement. The participants made a numerical expression, directly under the statement as to what extent they agreed with it. A high value signified a strong agreement.

When measuring preferences for scientific theories of intelligence, CHC-theory, Sternberg's Triarchic Theory and Gardner's Theory of Multiple Intelligences from Ackerman and Lohman (2006), and the socio-culture theory (Grigorenko, 2004), were presented to the future teachers in four summaries of between 71-104 words. The content of the summaries was agreed upon by the research team. All four summaries were presented on the same sheet in order to make it as easy as possible for the participants to compare the theories before making their estimates. A 10-point clear numerical scale was used when measuring how credible the future teachers thought the different intelligence theories to be, ranging from 1 = strongly disagree to 10 = strongly agree with the scientific explanations of intelligence.

Design

A 2 x 2 design was used where the first factor concerned where in the teacher education the student teachers study (first or last semester). This was a *between factor*. The second factor dealt with exposure to the g-factor theory (experimental or control condition) and was also a between factor. We matched 52 student teachers from the first semester with 52 student teachers from their last semester⁵. Random assignment was applied to split the participants at their first semester and the participants at their last semester in an experimental and a control group. The participants in the experimental condition were exposed to the g-factor theory. The participants in the control conditions were not. This was the only difference between the experimental and control conditions. We also used a 2 x 4 design with the first factor, a between subject factor, which dealt with the exposure of g-factor theory (experimental or control condition) and the second factor, a within subject factor, which dealt with scientific theories of intelligence (g-factor, Multiple, Triarchic and Socio-cultural Theory of Intelligence).

⁵ Two participants from the last semester did not complete the measures and were removed as missing values from the sample.

Procedure

Trained researchers (PhD exam) collected all the data. The future teachers did not receive any information about the aim of the study before their responses were collected and were asked not to speak to each other and not to go back to a sheet once they had finished it. The experimental group of students read a short summary of the scientific intelligence g-factor theory and were informed that they later would receive questions on this vignette. This was done in order to motivate them to attend more closely to the vignette than they might have otherwise done. The control group did not attend to any intelligence theory in the beginning but both they and the experimental group were asked to respond to the implicit theories of intelligence scale. Finally, the vignette of the g-theory was presented a second time together with the three other vignettes (Triarchic Theory of Intelligence, Multiple Theory of Intelligence and Socio-Cultural Theory of Thinking) and the future teachers from both groups were asked to assess their beliefs in the credibility of these theories. After every participant had finished the two groups received a full lecture in the subject area and in the specific aim of the study and were fully thanked for their participation.

Results

First we will introduce the results from the variance analyses of the effect on implicit theories of intelligence of exposing future teachers to the scientific g-factor theory of intelligence in the first versus and the last semester of their teacher education program. After this, the variance analysis of the credibility the future teachers attribute to the scientific theories and how this is influenced by exposure to a brief summary of the g-factor theory is presented. It is important to notice that a control for choice of program (preschool, elementary and secondary) on the dependent measures implicit theories of intelligence and credibility attached to scientific theories of intelligence was done. No significant effect was found. More specifically, the future teachers did not differ (dependent on which age group of pupils they were trained to teach) in their implicit theories of intelligence or in the credibility they attach to the scientific theories of intelligence in either the experimental or control condition.

A 2 x 2 ANOVA was performed on the dependent variable entity theories of intelligence between the two conditions of exposure to g-factor theory (experimental and control group) and first

versus last semester on the teacher educational program (see Table 1).

Table 1 about here

A significant main effect concerning the between factor exposure to g-factor theory on entity theories of intelligence $F(3, 98) = 5.77, p < 0.05, \eta = 0.06$ showed that those exposed to g-factor showed increasing beliefs in entity theories of intelligence ($M = 3.72$) compared to the control condition where no exposure had taken place ($M = 2.98$). No effect of first or last semester on the teacher educational program was found on entity theories of intelligence. It should be noted that the effect sizes were low. Further a between 2 x 2 ANOVA was performed on the dependent variable incremental theories of intelligence between the condition exposure to g-factor theory (experimental and control group) and first versus last semester on the teacher educational program (see Table 2).

Table 2 about here

A significant main effect on the dependent factor incremental theories of intelligence between first versus last semester on the teacher educational program $F(3, 98) = 6.00, p < 0.05, \eta = 0.06$ showed that the future teachers in the last semester showed weaker beliefs in an incremental theory of intelligence ($M = 5.79$) compared to the future teachers on their first semester ($M = 6.71$). It should be noted that the effect size were low.

Finally a repeated 2 x 4 ANOVA was performed with the between factor exposure to g-factor theory (experimental and control group) and within factor scientific theories of intelligence (CHC-theory, Triarchic theory, Multiple Intelligences and Sociocultural theory) (see Table 3).

Table 3 about here

The future teachers differed significantly between the credibility they attached to each scientific theory and this showed as a main effect on the within factor scientific theory $F(3, 93) = 9.16, p < 0.001, \eta = 0.23$. With adjustment for multiple comparisons by Bonferroni the credibility for the g-factor theory was less ($M = 5.30$) compared to Gardner's theory of multiple intelligences ($M = 6.26$) with a significance of $p < 0.05$. The credibility of the Triarchic theory was less ($M = 5.74$) compared to the Sociocultural theory ($M = 6.93$) with a significance of $p < 0.001$. Further, the credibility toward the Sociocultural theory was stronger than to those of the g-factor and Triarchic theory of intelligence with a significance of $p < 0.001$. Also an interaction effect was found concerning the influence for the exposure to g-factor theory $F(3, 93) = 3.11, p < 0.05, \eta = 0.09$. The credibility attached to g-factor theory increased with exposure for g-factor theory ($M = 5.69$) compared to the control condition ($M = 4.90$) and decreased for the Triarchic ($M = 5.39$) compared with control ($M = 6.10$), Multiple ($M = 5.90$) compared with control ($M = 6.62$) and Sociocultural theory ($M = 6.74$) compared with control condition ($M = 7.12$).

Discussion

The result concerning our first research question was confirmed. The group that was exposed to a short vignette describing g-factor theory increased their beliefs in entity theories of intelligence compared to the control group. This effect was the same no matter whether the g-factor vignette was presented during the first or the last semester. These results contradict Pajares (1992) conclusions that naïve beliefs (implicit theories) are hard to change among future teachers and are instead in line with Blackwell et al. (2007), where exposure to scientific theories was shown to have an impact. This is positive for teacher education as a way to influence tacit beliefs. We did not find any effect on incremental theories of intelligence from exposure to g-factor theory. However, that this short vignette summarizing g-factor theory has an effect on naive beliefs confirms that the literature used at the teacher education reveals it-self as *a transportation area of ideology*.

Our second research question concerned whether teacher education has any effect on the future

teachers. For incremental theories of intelligence a significant decrease was shown between the student teachers entering their first semester and those entering their last semester. No significant effect was found for entity theories of intelligence. Students completing teacher education believed intelligence to be less malleable, changeable and dynamic than those who were entering it did.

One suggested explanation to the decrease in the incremental theories from the first to the last semester could be that the English speaking literature that deals with questions about intelligence and ability, such as for example the *Handbook of Educational Psychology* (2006), represents a mainstream perspective of the habitual scientific construct of intelligence as innate and fixed (Plaut and Markus, 2005) and that this works in accordance with a manifestation in society of a general preference for the entity theory of intelligence and popular scientific genetic explanations of learning differences (Ahmavaara & Houston, 2007; Pramling & Säljö, 2007). The g-factor theory is one of the most established intelligence theories and by meeting it regularly future teachers would repeatedly and consistently activate representations of intelligence as fixed and innate (Bargh et al., 2001) in a manner that increases their confidence in these beliefs, not because they are more valid, but because of the repetitiveness of the process itself. There is an urgent need for further research concerning this issue⁶.

According to our results, which showed an immediate effect of the priming of g-factor theory by strengthening entity theories, a long-time effect of exposure to g-factor theory seems to seriously damage future teachers' beliefs in intelligence as dynamic and changeable. However, these results of the effect of teacher education on incremental theories of intelligence should be interpreted with great caution in that it is a small sample and culturally bound to Sweden. But it is still in the direction that it confirms the hegemonic goal structure. It will feel natural for these future teachers to categorize children in terms of their suitability for intellectual labor (Marx, 1945/2003). More specifically, when these future teachers for example co-operate with researchers such as Deary et al (2007) who state that cognitive ability depends upon genetic, inborn and fixed factors, it will seem natural for them to sort their own pupils in this manner.

⁶ As above our measurement was conducted during a short time interval and should be followed up but this should not detract from the seriousness with which the situation we describe is attended to.

They will not engage in resistance toward this kind of research. The habitual beliefs of intelligence as something fixed within the child and unevenly distributed among the population (Beach, 1999; 2001; 2003) has been successfully integrated in these future teachers minds.

In the third research question we suggested that Gardner's Multiple Theory of Intelligence would receive an increased credibility in contrast to the Triarchic Theory of Intelligence and the Socio-cultural Theory, which would both receive decreased credibility by people primed with the g-factor theory. This was only partly confirmed. The student teachers in the experimental condition rated the g-factor theory higher than the control group and the credibility they attached to Gardner's Multiple Theory, Sternberg's Triarchic and the Socio-cultural Theory of Intelligence also decreased. Here old elements seemed to direct the interpretation of the new and the current goal drove automatic non-conscious attention processes (Bargh, 2006). This means that if we introduce the student teachers to the g-factor theory first this may have an effect not only on the theory itself, in that it will become more credible, but also on the interpretations of theories that are introduced later, which will become less credible.

The results confirm in general the hegemonic project of legitimizing the sorting process of children to intellectual versus manual labor in school (Beach, 2003; Parker, 2007). But it also points to the usefulness of Marxist psychology, where a quantitative methodological approach (Jost & Jost, 2007) that is able to empirically test and confirm assumptions on a micro-mediating level can contribute to Marxist theory in large on a molar level of causation.

Study 2

Implicit theories of intelligence seem to differ among teachers from different knowledge domains (Myers, Nichols & White, 2003) and research suggests a distinction between hard- (e.g., mathematics and science) and soft domains (e.g., social science and humanities) (Bråten and Stromso, 2006). In previous studies we have investigated these issues and can confirm that it seems as if an entity theory of intelligence is stronger within mathematics (as a school subject)

compared to social science (as a school subject) and that an incremental theory is stronger within social science and practical disciplines compared to mathematics.⁷

This is in line with Bourdieu's (2000) suggestions that the neo-liberal enterprise favors the mathematic discipline and within research of general intelligence, true intelligence is to be interpreted as fluid (*gf*). Fluid intelligence is the deliberate and controlled mental operation which includes abilities as deductive, inductive and quantitative reasoning that represents the ability to solve mathematical problems (Ackerman & Lohman, 2006) and Gustafsson (1984) claims that the second-order factor of fluid intelligence is identical with the third order *g*-factor.

In a previous investigation (Jonsson, Beach, Korp & Erlandson, submitted), 226 secondary school teachers participated and filled in the Theory of Intelligence Scale (TIS) from Dweck (1999). The teachers in mathematics and science did not differ in preference between entity and incremental theories of intelligence. However, the teachers in social science and practical disciplines had significantly stronger beliefs in incremental theories and lower in entity theories.

There was a bias problem in this investigation however. This problem was that because we used a quasi-experimental design, the teachers, when filling in the scale, might have thought about their own everyday practice so that the teachers in math, when measured, would relate the TIS to their experience in math class and the teachers in social science to their social science class. Thus perhaps it was not the teachers as individuals that differed but the context.

In two subsequent investigations by Beach and Jonsson (submitted a; b), the first with 89 and the second with 151 participants, student teachers showed increased preferences for an entity theory of intelligence when the context was the knowledge domain of mathematics compared to that of social science. These were *within-individual* significant differences. More specifically, it seemed as if student teachers in general believe intelligence to be fixed and innate when it is measured

⁷ Gustafsson (1984) suggests an HILI-model in the psychometric tradition. We have no intentions in questioning the research results or questioning the empirical model in that we have no intentions to solve the question of what intelligence *de facto* is or is not. This study focus solely on what meaning teachers (and people) read into the concept of intelligence in order to enhance learning.

within mathematics and more incremental when it is measured within the context of social science.

Research Question

In this sense, the knowledge domain matters and our aim in the second study, is to investigate how implicit theories within mathematics and social science are influenced by the scientific theory of g-factor. More specifically, does the g-factor theory with its inborn and fixed approach have more impact on implicit theories of intelligence within the context of mathematics (as a school subject) compared to if the context is social science (as a school subject).

Method

Participants

177 student teachers participated in this second study. The students' ages were between 17 and 45 years old (mean 24). There were 151 women and 25 men. They were enrolled on preschool (110 students), elementary (45 students) and secondary (13 students) programs.

In order to control for differences between preschool, elementary and secondary school, a one-way ANOVA was conducted but no significant difference was found. The gender distribution is heavily influenced by sample emphases on early-years teacher education programmes and is nationally representative.

Measures

The same Swedish version of Dweck's (1999) Theories of Intelligence Scale (TIS) was used as in study 1. It was presented in the context of both mathematics and social science. Four items measuring an entity theory of intelligence (sample item "In math/In social science someone's intelligence is something about them that they can't change very much") and four items measuring an incremental theory of intelligence (sample item "In math/In social science people can always substantially change how intelligent they are") were used (see Appendix 2). Every participant received 8 items (4 entity and 4 incremental) related to math and 8 items (4 entity and

4 incremental) related to social science.

Our reliability analysis in this study showed that Cronbach's alpha for entity theory of intelligence items in mathematic was .784 and in social science .700 whilst it was .847 Cronbach's alpha for incremental theory of intelligence items in mathematics and .874 in social science. The same numerical scale as in the first study was used: i.e. a 10-point clear numerical scale ranging from 1 = strongly disagree to 10 = strongly agree with the statement. The participants made a numerical expression, directly under the statement as to what extent they agreed with it. A high value signified a strong agreement.

Design

A 2 (experimental versus control condition) x 2 (entity theories versus incremental theories) experimental design was used for a) mathematics and b) social science. The first factor was a between participant factor where half read the short summary of the g-factor theory and half did not. The second factor was a within participant factor that compared the same individual's ratings of entity theories with incremental theories. We used a convenience sample with a cohort design of future teachers randomized into either the experimental or control condition.

Procedure

Trained researchers (PhD exam) collected all the data. The future teachers did not receive any information about the aim of the study before their responses were collected and were asked not to speak to each other and not to go back to a sheet once they had finished it. The experimental group of future teachers read a short summary of the scientific intelligence g-factor theory and were informed that they would later receive questions on this vignette.

The control group did not attend to any intelligence theory in the beginning but both they and the experimental group were asked to respond to the implicit theories of intelligence scale. In that it was a within individual design it is important to notice that 50% of the participants rated their implicit theories (entity and incremental) in mathematics first and social science after that and 50% rated vice versa, more specific, order effects was attended to.

Results

Univariate variance analyses and t-tests were performed in order to investigate if the scientific g-factor theory in intelligence exerts different influence on the implicit theories of intelligence dependent on knowledge domain (mathematic, social science).

A 2 x 2 mixed ANOVA with the within variable entity versus incremental theories of intelligence and the between variable experimental versus control condition in the knowledge domain of *mathematic* was performed. Also a 2 x 2 mixed ANOVA was conducted with the within variable entity versus incremental theories of intelligence and between variable experimental versus control condition in *social science*. See table 4 below.

Table 4 about here

The first mixed ANOVA in the discipline mathematics revealed a main effect for the within variable implicit theory of intelligence; entity theory ($M = 3.63$) and incremental theory ($M = 6.39$), $F(1, 175) = 103.15$, $p < 0.001$, $\eta = 0.37$. The future teachers showed a stronger preference for incremental theories of intelligence compared to entity theories in math. Further an interaction effect was found between the variables entity theory in the control condition ($M = 3.35$), entity theory in the experimental condition ($M = 3.93$), incremental theory in the control condition ($M = 6.67$) and incremental theory in the experimental condition ($M = 6.08$) $F(3, 173) = 4.72$, $p < 0.05$, $\eta = 0.03$. The preference for an entity theory was higher and the preference for an incremental theory lower in the experimental condition compared to the control condition. No other effects were found.

For the second mixed ANOVA in the discipline of social science a main effect was found for the within variable implicit theory of intelligence; entity theory ($M = 2.65$) and incremental theory ($M = 7.50$), $F(1, 175) = 524.7$, $p < 0.001$, $\eta = 0.75$. The future teachers again showed a much stronger preference for the incremental theory compared to the entity theory of intelligence.

Moreover, even here an interaction effect appeared between entity theory in the control condition ($M = 2.48$), entity theory in the experimental condition ($M = 2.84$), incremental theory in the control condition ($M = 7.80$) and incremental theory in the experimental condition ($M = 7.18$), $F(3, 173) = 5.35$, $p < 0.05$, $\eta = 0.03$. The preference for an entity theory was higher and the preference for an incremental theory was lower in the experimental condition compared to the control condition. No other effects were found.

Discussion

In both mathematics and social sciences the preferences for an entity theory was higher and the preferences for incremental theory lower for those future teachers that read the short vignette summarizing g-factor theory. This is a successful replication of the first study and it deepens our understanding, in that we see that it is not only on a general level that implicit theories change but also in specific knowledge domains. This is in line with Blackwell et al. (2007) who showed that if the core message in a scientific theory matches an implicit theory, the implicit theory will adapt to the scientific. However, Blackwell et al. did not control for what happened with the entity theories in their study. Only the incremental were measured and followed through the experiment. We show here that both entity and incremental theories change when exposed to g-factor theory. This suggests again that g-factor theory supports the hegemonic structure and is incorporated in the teacher students' consciousness. Habitual naïve beliefs are formed and governed by implicit theories that constitute and build up the automatically operating goal structures that control executive processes within humans at an unconscious level (Bargh, 2006).

There was also a significant interaction effect which revealed that the future teachers hold stronger entity beliefs and lower incremental beliefs in mathematics compared to social science, where the reversed pattern appeared. This means that the same person, when acting within the discipline of mathematics, believes that intelligence is more fixed and inborn than when this same person acts within social science. This is in line with our previous research (Beach & Jonsson, a; b)) and supports Bourdieu's (2000) suggestions that the capitalist condition favors the mathematics discipline. Further, it seems as this is a common approach among researchers of general intelligence, in other words, that general intelligence is to be interpreted as fluid (*gf*) (Ackerman & Lohman, 2006; Gustafsson, 1984).

Another conclusion was that the future teachers showed stronger preferences in incremental theories compared to entity theories of intelligence in both mathematics and social sciences. This is indeed something for teacher education to build upon. Ahmavaara and Houston (2007) showed that society has a general preference for entity theories of intelligence. However, ours was not a random sample. It was a cohort sample of future teachers and it is very possible that their implicit theories differ from those of other groups in society.

General Discussion

Research shows that beliefs in entity theories of intelligence have devastating consequences for pupil learning and achievement (Dweck, 1999) and it is also suggested that these theories are hard to change in initial teacher education (Pajares, 1992; Murray, Nuttall & Mitchell, 2008). However, although it is society itself that has formed the teacher students' naïve beliefs and implicit theories, teacher education can do something about them, in as much as the choice of literature in teacher education is hopefully under staff control and the content of this literature, in terms of the scientific theories of intelligence it promotes influences the implicit theories future teachers develop. This is an important finding from the research.

Another important finding relates to the fact that entity theories of intelligence provide the most commonly accepted explanations of intelligence in society today (Ahmavaara & Houston, 2007). It is that one transportation area of these hegemonic ideologies is through the scientific theories presented in teacher education. From our results we suggest that implicit theories of intelligence are shaped in an unconscious manner at these specific *transportation areas* at the teacher educational programs. Our results confirm this at least when it comes down to the concept of intelligence. These implicit theories are then used as grounding structures upon which habitual beliefs and automatically operating goals will develop.

This is a very serious problem in that the scientific theories that we expose the future teacher to will not only influence their naïve beliefs, they will also alter their behaviour in class. According to Bargh (2006), Bargh and Ferguson (2000) and Bargh et al. (2001) representations will develop automatic associations with situations. Because of the overlap between perceptual and action

representations teachers will tend to act automatically on implicit theories of intelligence unconsciously.

In support of this theoretical framework Butler (2000) found that teachers holding entity theories of intelligence had a stronger preference of diagnosing pupils' ability from their initial achievement instead of diagnosing over time compared to those holding incremental theories. Further evidence comes from Leroy et al. (2007) and Trouilloud, Sarrazin, Bressoux and Bois (2006), who found that teachers holding entity theories of intelligence used more person-focused feedback praise and by this created a competitive climate in class in line with the neo-liberal ideas.

However, according to the research by Bargh (2006) it is no longer a question of one single concept influencing another isolated concept. Instead groups of concepts influence a net of interrelated concepts (of both perceptual and action nature) such as ideology. In our study 2 both entity and incremental theories were influenced by the g-factor theory. In other words, this means that the concept of "intelligence" could, dependent on what the future teacher associates it with, trigger anything from a democratic and dynamic point of view to an ideology of sorting human beings in categories in accordance with their results from different intelligence measures. This could lead to racism (Hernstein & Murray, 1994) and eugenic research (for a critical review of this see Gould, 1996) and it supports neo-liberalist value practices.

This neo-liberal project denies the importance of social factors, such as poverty and discrimination, for educational achievement (Jensen, 1969; 1998). Lynn and Vanhanen (2002) claims for example that the gap between poor and rich countries is due to genetic differences in national intelligence and that the money sent to the third world will not help in that the people in the third world are diagnosed as having too low an IQ to be able to handle the money in an effective way (for a review see Berhanu, 2007).

Some of the scientific international literature concerning intelligence theories promotes an entity theory of intelligence. This literature it seems may reinforce the view of intelligence that society, or more specifically the hegemonic class in society, support; i.e. as a fixed, inborn (genetic)

unchangeable entity. This understanding is closely related to the neo-liberal project of legitimizing the intellectual categorisation of human subjects (Parker, 2007) and is supported by the scientific g-factor theory, which also accounts then for why the g-factor theory is so prominent. It conforms to and even confirms the project of the hegemonic elite by incorporating false consciousness as a habitual belief. To change society toward a more inclusive form of democracy teaching critically about g-factor and the eugenic paradigm and other forms of intelligence theory that encourage an incremental approach to intelligence may be beneficial.

The possibility to change implicit beliefs through teaching selectively (and critically) about intelligence theories is supported by Blackwell et al. (2007), who showed that exposure to scientific theories that promotes incremental theories of intelligence have effects on pupils' implicit theories of intelligence, in that the beliefs in incremental theories increased when exposed to scientific theories that support this approach. The two studies reported on here produced the same results.

The most prominent among the intelligence theories today is the g-factor theory (Demetriou & Papadopoulos, 2004). This is problematic however, as this theory seems to prime entity theories of intelligence among future teachers and may affect their judgments about pupil ability. No matter what intelligence de facto is, which we have no intention to interpret here, the important aspect for the pupils and teachers is what they believe it to be as this steers their perceptions and behaviors in the learning situation⁸.

Limitations of the present article

There are several limitations that can be said to apply to our empirical studies. One is sample size. However, our intention is not to generalize our results to every student teacher at any point in time so this is less of a problem than it might seem. The results are to be used for a serious discussion and need to be replicated in other cultures and at different times. Moreover, we use an

⁸ Another aspect is that although it is the theory that is introduced by the literature as the only one with empirical support, in the control condition g-factor theory received the lowest credibility ratings. Instead the Socio-cultural Theory of Intelligence was rated highest in credibility. This was true also in the experimental condition. However, the credibility dropped for the Socio-cultural Theory when exposed to the g-factor theory. Further research is needed here and it would be interesting to study the student teachers' motivation concerning future work with pupils and their construction-reconstruction of implicit theories of intelligence when exposed to several different scientific theories of intelligence and not only one as in this article.

experimental design and ANOVA statistics to this end, where a large sample could actually be misleading, as with very large samples almost anything will show up as significant as two means can differ significantly with large samples but the difference is so small that it is of no use in practical work at schools. Significant results with around 20 participants in each condition could be taken more seriously. Another way of putting this is that ‘very few null hypotheses are true if one deals with very large samples and one will accept even the most modest of trends in the data’ (p. 40, Howitt & Cramer, 2005).

Another weakness is the sampling procedure, at least when this is considered from the general perspective of large-scale survey research and the Neyman-Pearson approach. However, following Fisher (1955), we reject the Neyman-Pearson logic of repeated sampling from the same population with the argument that there is no known population from which this sampling can be done. Another difference between survey research and experimental is the lack of control in surveys where people give their responses alone at home or on the anonymous web. This often provides data of quite low quality compared to experimental (and quasi experimental) design, where the researcher or an assistant guides the participants through each step in the study under controlled conditions. To use a convenience sample with a cohort and a quasi-experimental design where participants are randomized into different group conditions is a classical and accepted method of research.

A last limitation of the two studies was that the participants all came from one country, Sweden. This is highly problematic in that we take the perspective of Marxist psychology and also relate this to a socio-cognitive approach within research. This means that we in large place the explanations out-side the individual which make us especially vulnerable to cultural differences.

Conclusions

Our conclusions from the two studies conducted in the present investigation concerning teacher education is that when presenting the future teachers with scientific theories of intelligence, implicit theories of intelligence with the same core message will be strengthened. In more detail, 1) the theory of intelligence that is presented as the most valid theory in the Handbook of Educational Psychology by Ackerman, and Lohman, (2006) as well as by people in general

Ahmavaara and Houston (2007) is the g-factor theory, 2) a short vignette summarizing the g-factor theory increased the implicit beliefs in an entity theory of intelligence among future teachers in initial teacher education (study 1 and 2), 3) the same vignette also decreased the incremental theories of intelligence within mathematics and social sciences (study 2), 4) the same person believes to a higher degree that intelligence within the context of mathematics is fixed and inborn compared to social science, where intelligence is seen as more changeable and dynamic (study 2) and 5) the credibility the future teachers attached to concurring scientific theories of intelligence was influenced by being exposed to the short summarizing of the g-factor theory first compared to a control group (study 1).

These findings demand the attention of teacher educators. According to research on motivation, learning goals and feedback, it is better to encourage beliefs that intelligence is dynamic and malleable rather than fixed and inborn. This could be seen as an answer to the question; what should we teach the future teachers? Should we teach them that intelligence is a fixed structure or a dynamic process? At least we should not teach them first of all that intelligence is a fixed and inborn structure that the pupil either has or does not have. However, more important, we should encourage a critical reflection over the full consequences and assumptions of all different theories in relation to the successive democratic development of our society and its education systems. If we do this then it will become obvious that g-factor type theories are theories that are encouraged and operate in the interests of a dominant class and the continued exploitation of others in their interests by ideological means.

Future research has several areas to approach within this research framework and the tools of quantitative methods and an experimental approach within Marxist psychology could be very useful in this. However, it seems as if the present article may solve some questions but at the same time generate quite more to solve. Firstly it is necessary to grasp a better understanding of the influence of more than one scientific theory and how they work in concert with each other on implicit theories of intelligence in teacher education. Secondly, it is very important to investigate the link between scientific theories presented in teacher education to implicit theories among teachers and further to their actual behaviour in class. Thirdly, it seems as if implicit theories differ dependent on school subject and this is also an important issue to further investigate. Last,

we need studies from different countries in order to understand the full power of the g-factor theories influence on future teachers.

References

- Ackerman, P. L., & Lohman, D. F. (2006). Individual differences in cognitive functions (pp. 139-161). In P.A. Alexander & P.H. Winne (Eds.), *Handbook of educational psychology*. London: LEA.
- Ahmavaara, A., & Houston, D. (2007). The effects of selective schooling and self-concept on adolescents' academic aspiration: An examination of Dweck's self-theory. *British Journal of Educational Psychology*, 77, 613-632.
- Alexander, P.A., & Winne, P.H. (2006). *Handbook of educational psychology*. London: LEA
- Althusser, L. (1969/2005). *For Marx* (B. Brewster, Trans.) New York: Verso
- Bargh, J.A. (2006). What have we been priming all this years? On the development, mechanisms, and ecology of nonconscious social behaviour. *European Journal of Social Psychology*, 36, 147-168.
- Bargh, J.A., & Ferguson, M.J. (2000). Beyond behaviourism: On the automaticity of higher mental processes. *Psychological Bulletin*, 126 (6), 925-945.
- Bargh, J.A., Gollwitzer, P.M., Lee-Chai, A., Barndollar, K., & Trötschel, R. (2001). The automated will: Nonconscious activation and pursuit of behavioural goals. *Journal of Personality and Social Psychology*, 81 (6), 1014-1027.
- Beach, D. (1999). Alienation and fetish in science education. *Scandinavian Journal of Education Research*, 43(2), 157-172.
- Beach, D. (2000). Continuing problems of teacher education reform. *Scandinavian Journal of Educational Research*, 44 (3), 275-291.
- Beach, D. (2001). Alienation, reproduction and fetish in Swedish education. In G. Walford (Ed) *Ethnography and Education Plicy. (Studies in Education Ethnography Volume 4)*. New York: Elsevier.
- Beach, D. (2003). Mathematics goes to market. In D. Beach, T. Gordon, & E. Lahelma (Eds.), *Democratic Education: Ethnographic Challenges*. London: Tufnell Press.

- Beach, D., & Dovemark, M. (2005). Creativity as a cultural commodity: An ethnographic investigation of struggles over creativity in three Swedish schools, *Journal for Critical Education Policy Studies*, 4 (2), www.jceps.com
- Beach, D., & Dovemark, M. (2007). *Education and the commodity problem: Ethnographic investigations of creativity and performativity in Swedish schools*. London: Tufnell Press.
- Beach, D & Dovemark, M. (2009). Making Right Choices: An Ethnographic Investigation of Creativity and Performativity in Swedish Schools, *Oxford Review of Education*, 35(6), pp. 689–704.
- Beach, D. & Jonsson, A.-C. (submitted a). Different understandings of intelligence in math and social science among pre-service teachers.
- Beach, D., & Jonsson, A.-C. (submitted b). Maths subject knowledge, implicit theories of intelligence, teacher education and improving pupil learning.
- Berhanu, G. (2007). Black intellectual genocide: An essay review of *IQ and the Wealth of Nations*. *Education Review*, 10(6). Retrieved June 4, 2007 from <http://edrev.asu.edu/essays/v10n6index.html>.
- Bernstein, Basil (2000). *Pedagogy, symbolic control and identity*. Oxford: Rowman and Littlefield Publishers, Inc.
- Blackwell, L. S., Trzesniewski, K., & Dweck, C. S. (2007). Implicit theories of intelligence predict achievement across an adolescent transition: A longitudinal study and an intervention. *Child Development*, 78, 246-263.
- Bourdieu, Pierre. 1999. *Praktiskt förnuft- bidrag till en handlingsteori*. Göteborg: Bokförlaget Daidalos AB.
- Bourdieu, P. (2000). *Moteld*. Stockholm: Brutus Östlings Bokförlag
- Bråten, I., & Stromso, H. I. (2006). Predicting achievement goals in two different academic contexts: A longitudinal study. *Scandinavian Journal of Educational Research*, 50 (2), 127-148.
- Butler, R. (2000). Making judgments about ability: The role of implicit theories of ability in moderating inferences from temporal and social comparison information. *Journal of Personality and Social Psychology*, 78 (5), 965-978.
- Calderhead, J. (1996). Teachers: beliefs and knowledge. In D.C. Berliner, & R.C. Calfee (Eds.), *Handbook of educational psychology* (pp. 709-725). New York: MacMillan.

- Chartrand, T.L., & Bargh, J.A. (1996). Automatic activation of impression formation and memorization goals: Nonconscious goal priming reproduces effects of explicit task instructions. *Journal of Personality and Social Psychology*, 71, 464-478.
- Cohen, G.A. (2000). *Karl Marx's theory of history: A defence* (2nd ed.). Princeton, NJ: Princeton University Press.
- Cook, T.D., & Campbell, D.T. (1979). *Quasi-experimentation: Design and analysis issues for field settings*. Boston: Houghton Mifflin Company
- Deary, I.J., Strand, S., Smith, P., & Fernandes, C. (2007). Intelligence and educational achievement. *Intelligence*, 35, 13-21.
- Demetriou, A., & Papadopoulos, T.C. (2004). Human intelligence: From local models to universal theory. In R.J. Sternberg (Ed.), *International handbook of intelligence*. (pp. 445-474). New York: Cambridge University Press.
- Dupeyrat, C., & Mariné, C. (2005). Implicit theories of intelligence, goal orientation, cognitive engagement, and achievement: A test of Dweck's model with returning to school adults. *Contemporary Educational Psychology*, 30, 43-59.
- Dweck, C. S. (1986). Motivational processes affecting learning. *American Psychologist*, 41(10), 1040-1048.
- Dweck, C. S. (1999). *Self-theories: Their role in motivation, personality, and development*. Philadelphia: Psychology press.
- Dweck, C. S. (2007). The perils and promises of praise. *Educational Leadership*, 34-39.
- Dweck, C. S., & Legget, E. L. (1988). A social-cognitive approach to motivation and personality. *Psychological Review*, 95(2), 256-273.
- Eggen, P., & Kauchak, D. (2003). *Educational psychology: Windows on classrooms*. New Jersey: Pearson Education.
- Fisher, R. A. (1955). Statistical methods and scientific induction. *Journal of the Royal Statistical Society, Series B*, 17, 69-78.
- Furnham, A., Chamorro-Premuzic, A., & McDougall, F. (2003). Personality, cognitive ability, and beliefs about intelligence as predictors of academic performance. *Learning and Individual Differences*, 14, 49-66.
- Goodson, I. & Norrie, C. (2005: Eds). Work-package 1: A Literature Review of Welfare State Restructuring in Education and Health Care in European Contexts: First deliverable in the

EU sixth framework project *Professional Knowledge in Education and Health: Restructuring work and life between the State and the citizens in Europe*
<http://www.profknow.net/fs-results.html>.

- Gonida, E., Kosseoglou, G., & Leondari, A. (2006). Implicit theories of intelligence, perceived academic competence, and school achievement: Testing alternative models. *American Journal of Psychology*, 119(2), 223-238.
- Gould, S. J. (1996). *The mismeasure of man*. London: W. W. Norton & Company Ltd.
- Grigorenko, E. L. (2004). Is it possible to study intelligence without using the concept of intelligence? An example from Soviet/Russian psychology (pp. 170-211). In R.J. Sternberg (Ed.), *International handbook of intelligence*. Cambridge: Cambridge University Press.
- Gustafsson, J.-E. (1984). A unifying model for the structure of intellectual abilities. *Intelligence*, 8, 179-203.
- Hernstein, R.J., & Murray, C. (1994). *The bell curve: Intelligence and structure in American life*. New York: The Free Press.
- Hong, Y., Chiu, C., Dweck, C.S., Lin, D.M.s., & Wan, W. (1999). Implicit theories, attributions, and coping: A meaning system approach. *Journal of Personality and Social Psychology*, 77(3), 588-599.
- Howitt, D. & Cramer, D. (2005). *Introduction to Research Methods in Psychology*. Harlow: Pearson Education Limited
- Leondari, A., & Gialamas, V. (2002). Implicit theories of intelligence, goal orientations, and perceived competence: Impact on students' achievement behaviour. *Psychology in the Schools*, 39(3), 279-291.
- Jensen, A. (1969). "How much can we boost IQ and scholastic achievement?" *Harvard Educational Review*, 30, 1-123.
- Jensen, A. (1998). *The g factor. The science of mental ability*. Westport, CT: Praeger.
- Jonsson, A.-C., Beach, D., Korp, & H., Erlandson, P. (submitted). Teachers' theories of intelligence: influences from different disciplines and scientific theories.
- Jost, J. T. (1995). Negative illusions: Conceptual clarification and psychological evidence concerning false consciousness. *Political Psychology*, 16, 397-424.
- Jost, J. L., & Jost, J. T. (2007). Why Marx left philosophy for social science. *Theory &*

Psychology, 17 (2), 297-322.

Kenrick, D.T., Neuberg, S.L., & Cialdini, R.B. (2005). *Social psychology: Unraveling the mystery*. New York: Pearson Education.

Kunda, Z. (1999). *Social cognition: Making sense of people*. Cambridge, Massachusetts: The MIT Press.

Leroy, N., Bressoux, P., Sarrazin, P., & Trouilloud, D. (2007). Impact of teachers' implicit theories and perceived pressures on the establishment of an autonomy supportive climate. *European Journal of Psychology of Education*, Vol. XXII (4), 529-545.

Lundgren, U-P, Säljö, R. and Liberg, C. (2010: Eds). *Lärande Skola Bildning*. Stockholm: Natur och Kultur.

Lynn, R., & Vanhanen, T. (2002). *IQ and the wealth of nations*. Westport, CT: Praeger.

Malle, B. F. (2004). *How the mind explains behaviour: Folk explanations, meaning, and social interaction*. Cambridge: The MIT Press.

Massengill, D., Mahlios, M., & Barry, A. (2005). Metaphors and sense of teaching: How these constructs influence novice teachers. *Teaching Education*, 16 (3), 213-229.

Mather, R. (2003). Hegemony and Marxist psychology. *Theory & Psychology*, 13 (4), 469-487.

Murray, S., Nuttall, J., & Mitchell, J. (2008). Research into initial teacher education in Australia: A survey of the literature 1995-2004. *Teaching and Teacher Education*, 24, 225-239.

Myers, M.D., Nichols, J.D., & White, J. (2003). Teacher and student incremental and entity views of intelligence: The effects of self-regulation and persistence activities. *International Journal of Educational Reform*, 12 (2), 97-117.

Ommundsen, Y. (2003). Implicit theories of ability and self-regulation strategies in physical education classes. *Educational Psychology*, 23(2), 141-157.

Ostrove, J. M., & Cole, E. R. (2003). Privileging class: Toward a critical psychology of social class in the context of education. *Journal of Social Issues*, 59 (4), 677-692.

Pajares, M.F. (1992). Teachers' beliefs and educational research: cleaning up a messy construct. *Review of Educational Research*, 62 (3), 307-332.

Parker, I. (2007). *Revolution in psychology. Alienation to emancipation*. London: Pluto Press

Plaut, V. C., & Markus, H. R. (2005). The "inside" story: A cultural - historical analysis of being smart and motivated, American style (pp. 457-488). In A.J. Elliot and C.S. Dweck (Eds.) *Handbook of competence and motivation*. New York: The Guilford Press.

- Popper, K. (1945/1971). *The open society and its enemies* (Vols. 1 & 2). Princeton, NJ: Princeton University Press.
- Pramling, N., & Säljö, R. (2007). Scientific knowledge, popularization, and the use of metaphors: Modern genetics in popular science magazines. *Scandinavian Journal of Educational Research*, 51 (3), 275-295.
- Ritzer, G. (2008). *Sociological theory*. New York: McGraw-Hill
- Schommer, M. (1990). Effects of beliefs about the nature of knowledge on comprehension. *Journal of Educational Psychology*, 82, 498-504.
- Schraw, G., Benedixen, L.D., & Dunkle, M.E. (2002). Development and validation of the Epistemic Belief Inventory (EBI). In B.K. Hofer & P.R. Pintrich (Eds.), *Personal epistemology: The psychology of beliefs about knowledge and knowing* (pp. 261-275). Mahwah, NJ: Erlbaum.
- Spearman, C. (1904). "General intelligence", objectively determined and measured. *American Journal of Psychology*, 15, 201-293.
- Spinath, B., Spinath, F.M., Riemann, R., & Angleitner, A. (2003). Implicit theories about personality and intelligence and their relationship to actual personality and intelligence. *Personality and Individual Differences*, 35, 939-951.
- Sternberg, J. R. (1985). Implicit theories of intelligence, creativity, and wisdom. *Journal of Personality and Social Psychology*, 49, 607-627.
- Sternberg, J. R. (2004). *International handbook of intelligence*. New York: Cambridge University Press.
- Trouilloud, D., Sarrazin, P., & Bois, J. (2006). Teacher expectation effects on student perceived competence in physical education classes: Autonomy-supportive climate as a moderator. *Journal of Educational Psychology*, 98(1), 75-86.

Acknowledgement

This research was supported by the Swedish Research Council section for the Educational Sciences 2007-2009. Project title: Stereotypes, naive theories, cultural norms and their potential and actual effects on meta-cognition and school performance

Tabel 1. *Means (and SDs within parentheses) for a 2 x 2 between subject ANOVA on the dependent variable entity theories of intelligence between experimental versus control condition and first versus last semester.*

Entity theories	Experimental condition	Control condition	Total semester
First semester	3.62 (1.51) N = 26	2.80 (1.42) N = 26	3.21 (1.51) N = 52
Final semester	3.81 (1.85) N = 25	3.16 (1.40) N = 25	3.48 (1.65) N = 50
Condition	3.72 (1.67) *	2.98 (1.40)	3.35 (1.58)
Total	N = 51	N = 51	N = 102

* = $p < 0.05$ as an main effect compared to the control condition

Tabel 2. Means (and SDs within parentheses) for a 2 x 2 between subject ANOVA on the dependent variable incremental theories of intelligence between experimental versus control condition and first versus last semester.

Incremental theories	Experimental condition	Control condition	Total semester
First semester	6.71 (1.75) N = 26	6.71 (1.83) N = 26	6.71 (1.78)* N = 52
Final semester	5.24 (1.88) N = 25	6.34 (2.13) N = 25	5.79 (2.06) N = 50
Condition Total	5.99 (1.94) N = 51	6.53 (1.97) N = 51	6.26 (1.97) N = 102

* = $p < 0.05$ as an main effect compared to the final semester

Tabel 3. Means (and SDs within parentheses) for a 2 x 2 repeated ANOVA with the between factor experimental versus control condition and the within factor scientific theory (g-factor, triarchic, multiple and sociocultural theory) with $n = 102$.

Scientific theories of intelligence	Experimental	Control	Total
CHC-theory	5.69 (2.01) ^d	4.90 (2.43)	5.30 (2.26) ^a
Triarchic theory	5.39 (1.68) ^d	6.10 (2.00)	5.74 (1.87) ^b
Multiple theory	5.90 (2.37) ^d	6.62 (2.46)	6.26 (2.43)
Sociocultural theory	6.74 (2.13) ^d	7.12 (1.91)	6.93 (2.02) ^c

a $p < 0.05$ in comparison with multiple theory

b $p < 0.001$ in comparison with Sociocultural theory

c $p < 0.001$ in comparison with g-factor theory and triarchic theory

d $p < 0.05$ in comparison with the control condition in an interaction effect

Tabel 4. *Means (and SDs within parentheses) for two 2 x 2 mixed ANOVA with the within variable entity versus incremental theories of intelligence and between variable experimental versus control condition in first the mathematical discipline and second in social science.*

	Experiment condition	Control condition	Total
Mathematic			
Entity theory	3.93 (2.03)*	3.35 (1.62)	3.63 (1.85)***
Incremental theory	6.08 (2.23)*	6.67 (2.03)	6.39 (2.14)
Social science			
Entity theory	2.84 (1.55)*	2.48 (1.29)	2.65 (1.43)***
Incremental theory	7.18 (2.0)*	7.80 (1.62)	7.50 (1.83)

* = $p < 0.05$ as an interaction effect between the experimental and the control condition

**** = $p < 0.001$ compared with an incremental theory of intelligence

Appendix 1

Theories of Intelligence Scale – Other Form For Adults (Dweck, 1999)

The scale (without the word math or social science) is designed by Carol Dweck in order to investigate ideas about intelligence. In this study we have brought in the disciplines of math and social science into the items. Half of the participants first rated the 8 items below from the perspective of the mathematic (social science) discipline and after this rated the 8 items from the perspective of social science (mathematic) discipline.

- 1a) In math/In social science people have a certain amount of intelligence, and they can't really do much to change it.
- 2a) In math/In social science someone's intelligence is something about them that they can't change very much.
- 3b) In math/In social science no matter who someone is, they can significantly change their intelligence.
- 4a) To be honest, in math/in social science, people can't really change how intelligent they are.
- 5b) In math/In social science people can always substantially change how intelligent they are.
- 6a) In math/In social science people can learn new things, but they can't really change their basic intelligence.
- 7b) No matter how much intelligence a person have in math/in social science, they can always change it quite a bit.
- 8b) In math/In social science people can change their basic intelligence level considerably.

a = Entity theories of intelligence

b = Incremental theories of intelligence

Writers' details; Anna-Carin Jonsson and **Dennis Beach** both teach and research at the School of Education and Behavioural Sciences, University of Borås, Sweden

Correspondence Details: Correspondence should be addressed to Anna-Carin Jonsson, School of Education and Behavioral Sciences, University College of Borås, SE – 501 90 Borås, Sweden. Fax 46-33-4354006 Email: Anna-Carin.Jonsson@hb.se