



# **SPECIFIC INTERVENTIONS IN EQUITY FUNDING**

## A Review of Policy Interventions

**Kristof De Witte, Mike Smet & Ruben Van Assche**



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**Promotor: Mike Smet; Co-promotor: Kristof De Witte**

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Voor meer informatie over deze publicatie [Kristof.DeWitte@kuleuven.be](mailto:Kristof.DeWitte@kuleuven.be), [Mike.Smet@kuleuven.be](mailto:Mike.Smet@kuleuven.be), [Ruben.VanAssche@kuleuven.be](mailto:Ruben.VanAssche@kuleuven.be)

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# Beleidssamenvatting

Het aanbieden van gelijke onderwijskansen voor alle leerlingen staat hoog op de beleidsagenda in diverse landen en regio's. Dit rapport is het resultaat van een systematische internationale literatuurstudie en geeft een gestructureerd overzicht weer van de effecten van enkele gangbare beleidsmaatregelen. Deze review van internationale literatuur heeft een scherpe focus op (1) specifieke interventies gericht op het bevorderen van gelijke onderwijskansen én op (2) studies die via experimenten of quasi-experimenten toelaten om causale effecten te meten. We splitsen de bestudeerde beleidsmaatregelen op in interventies gericht op scholen (nl. verkleinen van de klasgrootte, duur van onderwijsprogramma's, extra financiering voor ICT, bijkomende financiering voor scholen met kansarme leerlingen), leerkrachten (nl. verbeterde werkomstandigheden en prestatiegerichte verloning) en leerlingen (nl. voucherprogramma's en voorwaardelijke betalingsprogramma's). Voor elk van deze interventies overlopen we, op basis van de eerdere wetenschappelijke literatuur, de oorzakelijke effecten die ze hebben op onderwijsuitkomsten en hun impact op gelijke onderwijskansen. Hierbij moet wel worden aangestipt dat de meeste literatuur uit het buitenland komt, wat niet altijd een 1-op-1 vertaling mogelijk maakt naar ons Vlaams onderwijsstelsel. Desalniettemin kan buitenlandse evidentie ons wel inspiratie aanreiken over interventies die bewezen hebben al dan niet te werken.

Wat betreft het resultaat van interventies op schoolniveau blijken er, volgens internationaal wetenschappelijk onderzoek, weinig eenduidige conclusies te trekken. Het verkleinen van de klasgrootte lijkt geen effectieve methode om de prestaties van leerlingen naar een voldoende hoog niveau te tillen, noch draagt het duidelijk bij aan de afbouw van ongelijkheid. De literatuur die licht positieve effecten vaststelt is niet omvangrijker dan de literatuur die negatieve effecten observeert. Ook de effecten op kansarme leerlingen zijn niet eenduidig positief. Bijkomende financiering om te investeren in ICT-materiaal lijkt geen significant effect te hebben op traditionele schooluitkomsten en testcores. Wetenschappelijke literatuur geeft aan dat investeringen in ICT niet leiden tot meer gelijke uitkomsten voor zowel kansarme als kansrijke leerlingen. De duur van onderwijsprogramma's verlengen en het uitbreiden van de dagelijkse lestijden lijken niet effectief te zijn. Terwijl de eerdere interventies op schoolniveau geen effecten sorteren volgens eerder onderzoek, lijkt het verlengen van de leerplicht, hoewel redelijk duur, een positief effect te hebben op gelijkheid van onderwijskansen.

Op niveau van de leerkracht lijkt een effectieve interventie deze met betrekking tot het reduceren van het verloop van leerkrachten. Veel achtergestelde scholen kampen met een hoger verloop van leerkrachten dan andere scholen. Werkomstandigheden in deze scholen verbeteren is dan ook een recent agendapunt geweest voor meerdere beleidsorganen. Hoewel het bewijs voor het effect van verbeterde werkomstandigheden eerder beperkt is, zijn de effecten van hogere lonen goed gedocumenteerd. Hogere lonen beperken het verloop van onderwijzend personeel. Dit is zowel het geval voor programma's die het loon onvoorwaardelijk verhogen als voor programma's die de individuele lonen van leerkrachten verhogen op basis van prestatie maatstaven. Wanneer we naar programma's kijken die groepen leerkrachten dienen te stimuleren, is het bewijs voor een gelijkaardig effect echter onduidelijk en beperkt. Loon naar prestatie is te prefereren, aangezien dit systeem niet enkel het verloop van de leerkrachten verlaagt, maar ook garandeert dat enkel de meest effectieve leerkrachten beïnvloed worden door dit beleid, wat de efficiëntie ervan ten goede komt.

De effecten van de programma's gericht op leerlingen en hun ouders blijken zeer contextafhankelijk. Hoewel voucher programma's positieve effecten lijken te hebben op uitkomsten van leerlingen, zouden de gemeten effecten een gevolg kunnen zijn van de verandering naar een private school. Daardoor valt er over het effect en nut van voucher programma's enkel iets te zeggen in de context van zeer gesegregeerd onderwijs, dat gekenmerkt wordt door grote kwaliteitsverschillen tussen de verschillende onderwijsnetten. Binnen deze context is de conclusie dat voucher programma's op een effectieve en efficiënte manier de gelijkheid van onderwijskansen kan verhogen. De zogeheten voorwaardelijke betalingsprogramma's, die ouders van leerlingen belonen met een financiële injectie als hun kinderen naar school gaan, lijken ook effectief wat betreft het verhogen van inschrijvingspercentages en het verlagen van problematische afwezigheden bij schoolgaande jeugd. Dit type van programma is echter enkel relevant voor armere gebieden, waar deze programma's de (opportunities)kosten van het naar school sturen van kinderen drastisch verlagen.

Geen van de besproken interventies kan dus unaniem bestempeld worden als goed of slecht. In praktijk ligt de waarheid eerder ergens tussenin en zijn de resultaten van een beleidsmaatregel sterk contextafhankelijk. Er zijn echter enkele interventies die, binnen een bepaalde context, consequent een positief effect lijken te hebben. Het verlengen van de leerplicht lijkt unaniem een positief effect te hebben op de resultaten van leerlingen en buitenproportioneel zo voor kansarme leerlingen. Zowel het verhogen van de nettolonen voor leerkrachten, als het belonen van doeltreffende leerkrachten verlagen de snelheid waarmee leerkrachten in kansarme scholen vertrekken. Daar dit type scholen gemiddeld geconfronteerd wordt met een gebrek aan ervaren leerkrachten verhogen deze interventies de billijkheid ('equity') en doeltreffendheid ('adequacy') van het onderwijssysteem. De studentgerichte interventies zijn, nog meer dan de andere maatregelen, sterk contextafhankelijk. De literatuur suggereert dat voucherprogramma's over het algemeen significante effecten hebben op testcores en hogere studies van leerlingen. Dit verschil wordt echter voornamelijk vastgesteld in contexten met een duidelijk kwalitatief verschil tussen publieke en private scholen. Het effect in andere gebieden is niet duidelijk. Ten slotte blijken ook de voorwaardelijke betalingsprogramma's, die gezinnen van studenten vergoeden wanneer deze naar school gaan, problematische afwezigheden en schooluitval te verlagen. Hoewel enkel relevant in relatief arme gebieden waar scholen geconfronteerd worden met veel afwezigheid, lijkt deze interventie een efficiënte manier om de meest kwetsbare groepen te bereiken.

Alles overziend stellen we vast dat de afgelopen 20 jaar de meeste interventies eerder beperkte effecten lijken te sorteren. Opvallend is dat de effecten in ontwikkelingslanden vaak wel nog relatief groot zijn, in tegenstelling tot meer ontwikkelde landen waar de effecten eerder klein of niet-significant zijn. Een hypothese die in verder onderzoek kan uitgediept worden is dat ontwikkelde landen zich in de buurt van de top van de onderwijsproductiefunctie zouden bevinden zodat, gegeven de huidige technologie, een toename van de inputs niet of nauwelijks zal leiden tot een hogere output. Gebaseerd op deze internationale literatuurstudie is een tweede hypothese dat onderwijs mogelijk niet in staat is om alle problemen in verband met gelijke onderwijskansen op te lossen. Kinderen beginnen aan hun onderwijs carrière met een sterk verschillende achtergrond inzake socio-economische kenmerken, immigratie, cultuur en taalverschillen. Verdere vooruitgang betreffende gelijke onderwijskansen moet dan misschien ook in een bredere en meer holistische benadering van gelijke kansen gezien worden. Deze hypothesen dienen enkel als mogelijke verklaring van de geobserveerde effecten uit de review van internationale literatuur.

# SCHOOL FINANCING AND EQUAL EDUCATIONAL OPPORTUNITY

## A Review of Policy Interventions

**Kristof De Witte<sup>a, b 1</sup> Mike Smet<sup>a, c</sup> and Ruben Van Assche<sup>a</sup>**

**(a):** KU Leuven, Leuven Economics of Education Research, Naamsestraat 69, 3000 Leuven (Belgium), Kristof.dewitte@kuleuven.be; Mike.smet@kuleuven.be; ruben.vanassche@kuleuven.be.

**(b):** Maastricht University, Top Institute for Evidence Based Education Research, Kapoenstraat 2, MD 6200 Maastricht (The Netherlands), k.dewitte@maastrichtuniversity.nl.

**(c):** KU Leuven, Work and Organisation Studies, Faculty of Business and Economics, Korte Nieuwstraat 33, 2000 Antwerpen (Belgium), Mike.smet@kuleuven.be

### **Abstract:**

This paper provides a structured overview of the literature on school financing programs in the context of equal opportunity in education. First, we summarize the literature on the main financing principles of equity, efficiency and adequacy. Second, we discuss several financing policies and programs, and their effect on equity, efficiency and adequacy. In particular, we discuss empirical evidence at school level on interventions rooted in class size reduction, extending school time, extra funding for ICT and additional funding for staff in schools serving disadvantaged students. The paper also reviews literature on interventions that impact teachers, such as higher net wages, improved working conditions, and incentive programs. Finally, we focus on interventions aiming at students and their families such as the effects of voucher programs and conditional cash transfer programs. We find that the effects of these programs are highly context dependent and differ significantly among interventions.

**Keywords:** Financing principles; Equity; Efficiency; Adequacy; Literature Review.

**JEL-classification:** H52; I22; I24.

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<sup>1</sup> *Corresponding author:* Tel.: 003216326656; *E-mail address:* Kristof.DeWitte@kuleuven.be.

## 1. Introduction

The aim and nature of equal educational opportunity have been the topic of debate since James Coleman's work *'Equality of Educational Opportunity'* (Coleman, 1968). His findings were initially interpreted as if schools do not make a difference at all. Almost 50 years later, however, the academic causal literature agrees that schools can make a difference for multiple outcomes, although there is no agreement on the underlying mechanism (Angrist & Lavy, 2002; Gamoran & Long, 2006; MacNeil, Prater & Busch, 2009). While some researchers claim that additional school resources do not have a persistent effect on educational achievement (Hanushek, 1997), others observe moderate effects on educational outcomes if the additional funding (e.g. additional staff, higher paid staff, additional operating funds, ...) is substantial (Graddy & Stevens, 2005; Greenwald, Hedges & Laine, 1996; Guryan, 2001). As policymakers have used a wide variation of interventions aimed at increasing equal educational opportunities, there have been multiple studies on the effectiveness of these interventions.

This literature review differs from earlier reviews (e.g., Fernández & Rogerson, 2003; Hanushek & Luque, 2003; Hoxby, 2001; Murray, Evans, & Schwab, 1998) as it focusses on specific interventions rather than financing systems. Moreover, for each intervention it distinguishes the effects on efficiency, equity and adequacy. We also focus on the causal effects of interventions.

The selected interventions aim to provide equal educational opportunities for students. We review the literature on the effect of policy interventions at school, teacher and student level. The former includes interventions as class size reduction, extending school time programs, extra funding for ICT and additional resources for schools serving disadvantaged students. At teacher level, we look at the effect of higher wages, improved working conditions and incentive programs, and examine their effect on educational outcomes of the students. At student level, we discuss empirical evidence on the effects of voucher programs and conditional cash transfer programs. Since there is no single exhaustive list of interventions, we selected these interventions after an initial investigation of the general equal educational opportunities literature.

We consider the effects of selected interventions on equity, adequacy and efficiency. In general, equity in funding (i.e. considering both operating expenses and staff spending), refers to achieving fair competition among schools (Blanchard, 1986). While this does not implicate that the final outcomes should be equal across schools and across pupils (i.e. equality in the outcomes), it implies that the general conditions in which schools and pupils operate, are either equal or are compensated for the observed differences (Blanchard, 1986). McGrath (1993) translates this general form of equity towards the context of financing education. He states (p. 1) that *"equity is a dual funding principle which acts as a means of ensuring that as much equality as possible is built into in the provision of educational services and as much fairness as is administratively feasible is applied to sharing the taxation burden for education among the general citizenry."* Policies to increase equity can therefore focus at increasing the educational facilities for people who receive relatively little education, or at reducing the cost for people that are carrying a larger taxation burden. The literature typically distinguishes between those variables that are beyond the influence of students, such as parental education, socio-economic status, race, or gender, which are so-called 'circumstances'; and those variables that are inherent to the student, like effort or intellectual ability (Alexander, 2004; Espinoza, 2007; Odden & Picus, 2000). These differences in circumstances form the basis for the distinction between horizontal and vertical equity. Horizontal equity means that schools or school districts that have comparable characteristics, such as wealth and size, and for which students have comparable circumstances,

should receive a comparable funding base. Vertical equity states that schools or school districts that have higher costs, because of unfavorable circumstances and characteristics, should receive a higher funding base (Toutkoushian & Michael, 2007). The general view is that circumstances that do not affect costs, such as race or gender, should have as little influence on resources per student as possible, while circumstances that increase the cost, such as disabilities or socioeconomic status, should increase the funding (Gorard & Smith, 2004).

There has been an increasing shift from equity towards a more adequacy-based system, aiming at equal outcomes rather than fair inputs (Clune, 1994). Whereas equity refers to a fair allocation of resources, adequacy corresponds to achieving a particular level of outcomes for everyone. Both equity and adequacy are moral and legal terms meant to making school financing fair (Baker & Levin, 2014). Where equity looks at the inputs needed to achieve a certain outcome, adequacy focusses on a certain outcome and distributes the budget in order to allow every school district to reach this goal. Adequacy explicitly links the availability of funds to the educational performance of students (Reschovsky & Imazeki, 2001).

Despite the conceptual distinction between equity and adequacy, both terms are increasingly used interchangeably, up to the point that equity and adequacy are often used to describe the outcome gap between advantaged and disadvantaged students (Gorard & Smith, 2004; Hanushek & Luque, 2003). In other words, both are currently used to improve equality in education. In this review, we use equity only in the context of an increase in funding for schools or students with unequal starting positions, different social or economic statuses, migrant status, ... Most of the policies discussed, however, will have a more adequacy based goal, in which they try to raise all students to a certain adequate level of education. Both equity and adequacy are means to achieve a more equal educational system.

The third financing principle is efficiency. This refers to achieving the outcomes with as little resources as possible (input-efficiency), or maximizing the outcomes for a given level of resources (output-efficiency). The literature on efficiency in education applies a wide variety of input and output variables. A review of this literature is provided by De Witte & López-Torres (2017). Not all variables need to be expressed in financial terms. For instance, student and family variables like prior academic achievement, minority status, socioeconomic status, parental education or peer groups are not formulated in terms of financial inputs. Many school related input variables such as number of personnel, expenditures, school resources and teacher salary are typically formulated in terms of financial inputs (De Witte & López-Torres, 2017). Widely applied output variables are test scores, teacher value added, student achievement or attendance rates (De Witte & López-Torres, 2017; Portela, Johnes, & Thanassoulis, 2016). The literature on efficiency in education is a strongly developed literature, which is beyond the scope of this paper. When discussing the efficiency of a program in the following chapters, we will discuss the impact on multiple outcomes, and its relationship to its cost and resource usage if available.

It should be noted that while most school financing programs solely aim to increase equity or to achieve certain adequacy standards, they often have an effect on each other (Rice, 2004). A policy aimed at increasing the efficiency might reduce equity, while a program aiming to increase equity could have a positive effect on efficiency as well. Historically people felt like there was a trade-off between equity and efficiency. Rather than supplements, however, these principles seem to be unrelated in many cases and may even be complementary (Hoxby, 1996; Rice, 2004; Wößmann, 2008).

The paper unfolds as follows. Section 2 discusses the methodology of the review. Section 3 overviews the available literature for each of the policy interventions. Section 4 concludes the review.

## 2. Methodology

This paper is based on a systematic review of the literature. To set the scope of the systematic review, we did an explorative literature review. The aim of this initial analysis is to identify frequently used interventions to increase (1) equity (i.e. input oriented Equal Opportunities of Education (EEO)) or (2) adequacy (i.e. output oriented EEO). Policies to increase adequacy may include interventions (1) intended to lead to more equal outcomes and (2) interventions that pursue an improvement of the (absolute level of) outcome, not necessarily for a disadvantaged group. The initial analysis led us to reviews by Toutkoushian & Michael (2007), Hoxby (2001), and Wößmann (2008), and the references therein. After this stage, we selected the main (financial) interventions that are used to increase equal educational opportunities: class size reduction, extending programs, extra funding for ICT and additional resources for schools serving disadvantaged students, teacher wages, teacher working conditions, both group and individual incentive programs, voucher programs and conditional cash transfer programs. We grouped the interventions into three broad types: those aimed at schools, those aimed at teachers and those with the direct aim of influencing students and their families. For each of these types, we have chosen policy interventions that are primarily of a financial nature. Interventions that influence equal educational opportunities through non-school financing interventions, will not be discussed as they are not relevant in this context. Although every intervention has a certain cost, we only consider those interventions that directly increase funding for staff, materials and or students.

After identification of the relevant interventions, we conducted a systematic literature review. Using Web Of Science, we took into account all papers that can be found by using the following search terms: We include the name or several synonyms for the intervention (e.g. class\* size) AND (education\* or school\*) AND (\*experiment\* or causal\*). For relevant papers, we use a snowballing technique to analyze the cited literature in the selected paper. As an inclusion criterion, we only consider studies that use either experiments or quasi-experiments and, as such, yield causal evidence. The selected literature is then further reduced to only include results that have an impact on equality and/or adequacy. As the terminology for adequacy, equity and equality is relatively broad and not consistently used, the abstracts will shed more light on the use of any of these outcomes. Since the literature on some of these interventions is limited we used a rather extensive time window ranging from 2000 to August 2017.

## 3. Policy interventions

### 3.1 School interventions

In this section, we discuss all interventions that have a direct impact on any type of funding of schools. These include the effects of class size reduction, additional money to spend on ICT materials, extension of an educational program and extra funding for staff for schools with a high proportion of disadvantaged students.

#### 3.1.1 Class size reduction

It is generally believed that larger classes are unfavorable for the educational attainments of students. In particular, it is suspected by parents that a teacher in a larger class devotes less attention to individual students than in a smaller class (Bennett, 1996). Therefore, high socio-economic status parents tend to send their children to schools with smaller classes (Angrist & Lavy, 1999; Bosetti, 2004; Goldring & Phillips, 2008). Despite this underlying mechanism of self-section of high socio-economic status students in smaller classes, the belief that a reduction of the class size leads to better performing students and that this seems to benefit students with disadvantaged backgrounds even more than

those with a non-disadvantaged one, has lead several policymakers to reduce class-sizes and therefore increase the teacher/student ratio. The causal evidence of similar class size reductions is mixed.

In the STAR experiment, where pupils and teachers were randomly assigned to classes of different sizes, the positive effect of smaller classes was empirically shown (Krueger & Whitmore, 2001). Ding & Lehrer (2010) reevaluate Project STAR using dynamic treatment effects in randomized trials. They find significant positive effects of smaller class size on all subject areas in kindergarten and first grade. Nevertheless, despite the experimental setup, several arguments limit the external validity of the STAR experiment (Hoxby, 2000). It is therefore not clear whether the results hold for other regions and countries. When evaluating the effect of Project STAR on equity, Nye, Hedges, & Konstantopoulos (2002) find no significant difference between the effects on disadvantaged and other students. Shin (2012), on the other hand, investigates Tennessee data on student teacher ratios to see if a reduction in class size has a higher impact on educational outcomes of black children than on those of other children. He shows that the effect is significantly larger for black children than for others. As such, it raised the equality within schools and reduced the outcome gaps between pupils.

A Dutch study, using a regression discontinuity design, finds that pupils in smaller classes perform worse than those in larger classes. This effect can, however, be attributed to the reduction of the number of pupils in a class with a similar level of competence, following social cognitive learning theories (Dobbelsteen, Levin & Oosterbeek, 2002). When the amount of similar students is taken into account the resulting class size effects are irregular (Levin, 2001). In general, even though the largest effects of smaller classes are found at schools with higher proportions of disadvantaged students (Angrist et al., 2015), the effects are usually small and disputed (Rivkin, Hanushek, & Kain, 2005).

Using a difference-in-differences strategy, Chaudhary (2009) estimates the impact of the school finance reform in Michigan in 1993. One of the goals of this reform was to increase spending on low-spending districts. Not only did funding increase in these low-spending school districts, \$5000 per-pupil or less, but also in higher spending districts. The additional funds were used to increase teacher salaries and reduce class sizes. She finds that the results on the beneficial effect of smaller class sizes is inconclusive.

In a recently published paper Konstantopoulos & Shen (2017) study the effects of class size reductions on reading achievement using the PIRLS data. They find no significant effects in most European countries with the exception of Romania, where the research suggests that a smaller class size increases the reading achievement. Jahanshahi & Naghavi (2017) use a difference-in-differences strategy to evaluate the effect of the 2009 Gelmini education reform in Italy. This reform had a severe impact on the number of teachers, which in turn increased class sizes. They find that students with an immigration background lost more than native students. For family background, however, such effect was not found. Li & Konstantopoulos (2016) use an instrumental variable and regression-discontinuity approach to investigate the causal effects of a class size reduction. Except for Romania and the Slovak Republic, they find no consistent class size effects across Europe on mathematical achievement. Using an experimental approach Duflo, Dupas, & Kremer (2015) evaluate a Kenyan program that focused on reducing class size, among other things. From a developed country perspective, this was the only relevant policy change. When comparing students in classes that were almost halved to students in the original 80-student classes. They found no significant increase in test scores.

Akabayashi & Nakamura (2014) research the effect of a reduction in class size both on the average school and as a policy to reduce the gap between schools, using a regression discontinuity approach. By only reducing class size in less advantaged schools the program aimed at an increase in equity across schools. They find significant positive effects of a reduction in class size on language test scores. The

effect however is larger for schools in wealthy area's and as such is not able to close the achievement gap between schools, but instead decreases adequacy of the less advantaged schools.

Leuven, Oosterbeek, & Rønning (2008) use an extensive Norwegian administrative dataset to examine the effects of smaller class sizes on educational outcomes. They exploit maximum class-size rules in a regression discontinuity approach. They, however, do not find any significant effects of smaller class sizes and can even rule out small effects over long term class size interventions. Using the same Norwegian class size policies, Bonesrønning (2003) finds small negative class size effects. The individual effect, however, highly fluctuates. Bonesrønning suggests that students' effort might be highly correlated with the effect of class size on educational outcomes. It is also possible to look at the interaction effects between class size and environmental factors. Mueller (2013) finds that class sizes do have an impact, but only when used in combination with a senior teacher. Moreover, he suggests that senior teachers in turn, only increase educational achievement in smaller classes. Bressoux, Kramarz & Prost (2009) use administrative mistakes, to draw causal conclusions on the effect of class size in France. They find that a reduction in class size improves students' educational outcomes. This is especially the case for initially low achieving students thus increasing the outcomes of those students that needed to be raised to achieve an adequate level of education. There is, however, no information on the socioeconomic background of these underperforming students. Ecalte, Magnan, & Gibert (2006) also examined the effect of class size on literacy skills in France. Using an experiment, they find that the performance of students in small classes improved. This was not the case for students from disadvantaged backgrounds or for students whose mother tongue was not French. As such, reducing class size decreased equal educational opportunities rather than promoting it.

In sum, reducing class sizes is not an effective way to improve educational outcomes. Not only are the effects on educational outcomes contradictive, the proportion of the literature that suggests negative effects is equally large as the part that claims positive effects. Moreover, the specific effects on disadvantaged students are not consistent over multiple programs and countries and most of the discovered positive effects are small. We conclude that the effect of reducing class sizes seems largely overestimated. To raise the educational outcomes of students to an adequate level, reducing class sizes does not perform well on a consistent basis. Even if the effects were slightly positive, class size reductions are a costly affair and would not be the most efficient way of increasing educational achievement (Mueller, 2013).

### 3.1.2 Extra funding for ICT-materials

Resource driven policies can increase certain facilities for particular schools. Investments in ICT infrastructure provides a motivation for providing additional resources, as there are clear differences in ICT infrastructure across schools, and as ICT infrastructure needs a continuous update. Moreover, it is often assumed that ICT infrastructure is correlated with student achievement, although the underlying mechanism might be self-selection of high socio-economic status students in schools with a better ICT infrastructure.

Causal evidence indicates that the effect of investments in ICT on student achievement is poor, at best. Leuven et al. (2007) exploit the effect of additional resources for ICT in the Netherlands in a regression discontinuity design. They measured student test scores for language, arithmetic and information processes in the years following a policy intervention and compared them to those before the intervention. They could use a regression discontinuity design as schools that had over 70% disadvantaged students were awarded an additional 209 guilders per student to invest in ICT and those with less than 70% disadvantaged students received no additional funding (Leuven, Lindahl,

Oosterbeek & Webbink, 2007). The study concludes that both in the treatment and the control group the computer/student-ratio and the age of computers are the same. Nevertheless, they observe a significant difference in the amount of school-time students use a computer. The extra computer time, however, seems to reduce test scores. This is in line with Angrist & Lavy's (2002) conclusion on Israeli schools that won new computers after a state lottery. 4<sup>th</sup> Graders in schools that won the lottery had significantly lower math scores than those in schools that did not. An explanation for these differences is that in-school computer-time is most likely to replace instructional time for traditional skills, thus (marginally) reducing test scores for these skills (Leuven & Oosterbeek, 2003).

While programs increasing funding for ICT may seem ineffective, this could be due to the outcome measures used, as the outcome measures are, in many cases standardized test scores that do not include ICT-skills. If computer-based learning however is less efficient than traditional teaching methods, these programs may very well decrease equality and increase the educational gap (Leuven & Oosterbeek, 2003). Machin, McNally & Silva (2007) also investigate the contemporary topic of ICT funding in schools. Using an instrumental variable approach, they find significant positive effects of additional funding for ICT on both English and science. These results are not consistent with the ones for science. Moreover, they do not find that the ICT programs motivated by the UK government, promote equal educational opportunities, even though some of the programs were originally aimed at improving the equity of funding across schools. Hanushek, Machin & Woessmann (2016) mention the large amount of money that is being spent on technology in education. As many of these interventions are expensive, the efficiency of the programs is debatable. They suggest no large positive effects of technology investments both in schools and at home, should be expected on educational outcomes, although they find some exceptions in developing countries. Both for a cost-benefit analysis and for the effect of ICT funding on disadvantaged students they suggest further research is needed. De Witte & Rogge (2014), to conclude, use the TIMSS dataset to explore the effect of additional ICT funds on the effectiveness and efficiency in education. Using a matching analysis, they find that the effect of additional funds for ICT is highly dependent on other factors such as student, school, teacher and regional factors. As such they do not express any significant results on the effect of ICT in education.

In sum, the topic of additional funding for ICT is a complicated issue. While for traditional educational outcomes and test scores the effects of extra funding for ICT is generally positive to mixed, information on more modern educational outcomes such as technological literacy and the value of computer skills remains largely unexplored. Not only is the evidence underwhelming at best, several authors remark the relatively high costs of investing in technology. Further research is needed for more modern outcomes, especially in the light of increasing deficiencies of educated employees regarding ICT. Until these results become available, investing in ICT does not seem an efficient way of improving the more traditional educational outcomes. Finally, this type of programs does not have the desired effects to increase equity at disadvantaged schools.

### 3.1.3 Extending programs

Many policy initiatives aim at providing young people with minimum (adequate) levels of general skills. Several studies evaluate the effectiveness of extended education (Aakvik, Salvane, & Vaage, 2010; Oosterbeek & Webbink, 2007; Oreopoulos, 2007; Palme & Meghir, 2005). While some studies, such as Leuven and Oosterbeek (2003) and Palme and Meghir (2005), do not show significant changes in wages for those receiving extra education, others observe highly significant and substantial returns (e.g., Oreopoulos, 2007; Aakvik et al., 2010). It seems that an important factor for the added value of an extra year of education is an increase in the highest degree obtained (Oosterbeek & Webbink, 2007;

Pischke, 2007). Oosterbeek and Webbink (2007) conclude that individuals attending lower vocational programs do not benefit in terms of later wages of additional education. As studies confirm that students from high socio-economic status groups are more likely to choose a high level of education than disadvantaged students this reduces the impact of policies of this kind on closing the educational gap.

When we look at the direct effect of these reforms on disadvantaged students, however, Aakvik et al. (2010) states that the effect of family background on educational attainment was weaker after a Norwegian reform that extended the duration of mandatory education. The reforms smoothed transition to higher levels of education and increased equality among the socio-economic lines. For vocational programs, however, the effect of the reforms is not significant (Aakvik et al., 2010). Both the Norwegian reforms and comparable reforms in Sweden increased schooling beyond the new compulsory level for individuals with higher ability and unskilled fathers and increased labor market earnings for individuals with unskilled fathers (Aakvik et al., 2010; Palme & Meghir, 2005). While increasing the length of a program does not seem to be an effective technique of increasing educational equality, increasing the duration of compulsory education seems to increase equality.

A second method of extending programs, rather than adding additional years of education is through increasing instruction time. Meyer & Van Klaveren (2013) evaluate the effectiveness of a Dutch program that extended instructional time through an extended day program. Using a randomized field experiment, they find no significant effects on either language or math test scores. Specifically aimed at researching the effect of additional instruction time in low-achieving schools, Battistin & Meroni (2016) evaluate several Southern Italian programs funded by the European Social Fund. They use a difference-in-differences strategy to compare participating and non-participating students within the same schools. They conclude that the program increased test scores for the most disadvantaged students. The average positive effects however, are mainly driven by the increase in scores for the best students.

In sum, extending the length of individual programs does not seem to yield the expected results. Extended programs aimed at improving the adequacy of vocational programs, provide very low positive effects on lifetime earnings and starting wages. An increase in the duration of compulsory education, however, seems to decrease inequality among students. A final method of increasing the duration of a program is extending the daily instruction time. This type of research is limited, but the few causal studies on this topic seem to suggest that the effects of these interventions on the adequacy of the programs is limited at best. Overall, it seems that increasing the duration of compulsory schooling is a unanimously accepted method of helping every student to reach certain adequacy standards. While the cost of an additional year of compulsory education is highly significant, countries where mandatory education is limited, could increase equal educational opportunities by extending this period. Increasing the duration or instruction time in a non-mandatory fashion do not seem to have a significant impact on educational outcomes.

#### 3.1.4 Extra funding for staff in schools serving disadvantaged pupils

Resource driven policies target schools serving disadvantaged pupils. In the Flemish region of Belgium, personnel subsidies have been assigned to schools serving disadvantaged pupils. A weighted sum was calculated for each pupil, based on four SES-indicators: the child is not living with its biological parents, it is part of a traveling population, the mother of the child did not attain a degree of secondary education and the child's mother tongue is not Dutch. Based on this weighted sum additional funds were allocated to schools. A school could only claim these extra resources if their percentage of

disadvantaged students was higher than 10%. A school that received additional funding could use them for remediation, language proficiency or improving socio-emotional skills. The clear cutoff at 10% was used by Ooghe (2011) in a regression discontinuity design. Significant positive effects are found for spelling scores only, while the program was not effective in improving mathematics and reading scores.

With respect to equity, the effects in Ooghe (2011) are larger for disadvantaged students based on the family background than for advantaged ones. The opposite is true for students with a lower initial score. The most efficient implementation theme, when we take average improvement as an outcome, seems to be socio-emotional development, as these schools seemed to perform better on average. Schools that focus on the other themes may however still do better when we consider the relative improvement of students that initially lag behind.

With respect to causal evidence, our systematic search only found one other study with respect to additional funding for disadvantaged students. Henry, Fortner, & Thompson (2010) use a regression discontinuity design to analyze the effects of supplemental funding on student test scores. In North Carolina, schools in targeted districts received an additional \$250 per pupil and \$840 per disadvantaged student. They find significant positive effects on students' test scores. The average treatment effect, however, was almost 1.5 times as high as the effect on disadvantaged students. While the program definitely increased both equity and adequacy, the equality of the educational system was far from improved within the participating schools.

As this section of the literature is very limited, the discussed results do not necessarily reflect the effects of this type of programs. While both studies seem to suggest this type of program slightly increase the adequacy of the students' educational outcomes, the costs are very high, and as discussed by Henry, Fortner, & Thompson (2010) this type of program does not necessarily increase equality.

## 3.2 Teacher interventions

This section discusses the existing causal evidence of additional wages, better working conditions and performance related pay on equity, efficiency and adequacy.

### 3.2.1 Teacher working conditions

Resource driven policies often aim for additional funding for personnel, such as teachers, school managers, or student councilors. This should improve the working conditions, e.g., by improved facilities or better work balance. This subsection discusses the causal evidence of similar policies.

Starting teachers perform, on average, worse than their counterparts with several years of experience (Hanushek, 2007). While there are starting teachers in every school, minority students are thought to face more of these unexperienced teachers than other students as teachers also have preferences for the schools they teach in (Rice, 2010). They seem to look for schools with higher-achieving students and fewer disadvantaged or minority students and more experienced teachers are more likely to transfer to one of these preferred schools (Hanushek, 2007). Therefore, policy makers use resource driven policies to improve the working conditions of teachers in minority schools. Evidence from the Netherlands exploited in a quasi-experimental design that every primary school with at least 70% minority students received an additional 13.000 guilders per teacher. This lump-sum financing was spread over two years and schools were required to use the money to improve teachers' working conditions. Using a regression discontinuity design, Leuven et al. (2007) evaluated this policy. When looking at student achievement in schools that had a little over 70% minority students and those that had a little less than 70% minority students, they found that none of the effect estimates differed significantly from zero (Leuven et al., 2007). While increasing the funding for personnel in schools with

high percentages of minority students aims to increase the equality of outcomes and thus achieving a level of adequacy, the intervention turned out to be ineffective. It is, however, important to note that schools in the Netherlands already receive compensatory funding for both staff funding and operating expenses for large shares of disadvantaged students. Rather than concluding there is no added value for student achievement in extra funding for personnel, the conclusion is that a level of resource adequacy can be, and in fact was, reached. In order to reduce the teacher turnover in disadvantaged schools in New York City, Kraft, Marinell & Shen-Wei Yee (2016) review the relation between teacher turnover, organizational contexts and student achievement. They also find that a decrease in teacher turnover increases student achievement. Using an instrumental approach, they find that an increase in school safety, academic expectations and teacher relationships leads to a significant reduction in teacher turnover. While not strictly an evaluation of a financial program, this research shows that teacher working conditions can have a significant impact on students' educational outcomes. With regards to organizational changes one study reviewed the effect of an increase in the principal's wage on school outcomes. Lavy (2008) finds that a 50 percent increase in the principal's salary leads to significant improvements in twelfth-grade students. He argues, that the lack of causal evidence regarding increasing teachers' wage as such leads to the conclusion that priority should be given to increasing the headmasters' salary.

In sum, the causal literature on improving working conditions through higher wages, higher paid principals and more favorable teaching rooms is limited. We do think that this aspect of educational funding bears significant importance as the literature indicates a high teacher turnover in disadvantaged schools and that this turnover can be decreased by increasing working conditions.

### 3.2.2 Teacher wages

Using Texan data Hendricks (2014) shows that increasing teacher pay reduces teacher turnover. This effect is largest for inexperienced teachers and does not vary over the subject taught and the teachers gender. The study concludes that increasing pay for inexperienced teachers, reduces turnover and, as a consequence, increases the average experience of teachers in a state. There has not been any follow-up research on the assumptions that a flat salary schedule does not alter the effort choices of veteran teachers and also the assumption that the distribution of new teachers is not influenced remains unproven. Another study on teacher wages comparing data on more than 3,000 English schools containing around 200,000 teachers found that teachers do respond to pay (Britton & Propper, 2016). A shock of 10% to the wage gap between teacher wages and local labor market leads to an average loss of 2% in average school performance in key exams. Both studies counter earlier findings by Hanushek (1997, 2003) in which it is stated that teacher pay is not correlated with student performance. The main reason the literature does not find any consensus on this subject is that estimating the direct causal link between teacher payment schedules and student performance is challenging. Different studies use different outcomes and the effects of additional teacher pay are very teacher-specific.

With respect to equity, one approach is to provide a higher salary for teachers in schools with many disadvantaged students. Similar schools have a lower attrition, such that teachers need a higher compensating wage. High-poverty schools and schools that face low test scores face difficulties in retaining experienced teachers (Hanushek, 2007). The State of North-Carolina awarded an annual bonus of \$1,800 to certified math, science and special education teachers working in public secondary schools with either high-poverty rates or low test scores, for a duration of three years. The aim of the program was to reduce teacher turnover. Not only did the bonus payment reduce mean turnover rates by 17%, it also seemed to affect experienced teachers more than inexperienced ones (Clotfelter,

Glennie, Ladd, & Vigdor, 2008). While the results in this study are rather optimistic an important side-note is the fact that the effect of these policy interventions on student test scores has not yet been measured as it is likely to have a long-term effect rather than a short term one. The effect of experienced teachers and thus of teacher attrition is well accepted within the literature (Ferguson, 1991). A second remark suggested by Clotfelter et al. (2008) is that the program spent \$36,000 dollars for every teacher departure that was averted or delayed. While this kind of policy is likely to raise the equity of the school system, the effects have not yet been analyzed and the costs are rather steep.

In sum, raising teachers' wages in schools with disadvantaged students seems to decrease the teacher turnover rate. As more experienced teachers tend to leave these schools for other non-disadvantaged schools, disadvantaged schools often face a less experienced team of teachers. The effects of higher teacher wages on student outcomes is not well documented however. As such, the conclusion that higher teacher wages lead to an increase in adequately performing students is based on the assumption that a lower turnover rate in turn increases the students' educational outcomes. These programs increase the equity of the educational system, by increasing the amount of (more expensive) experienced teachers in disadvantaged schools. Depending on the program the costs vary and as such efficiency depends on the implementation of the program.

### 3.2.3 Teacher incentives

As the academic literature agrees on the fact that teachers have a substantial effect on student achievement growth, many policies try to reward those teachers that make the biggest difference (Podgursky & Springer, 2007). As the literature does not agree on whether or not teachers' teaching certificates, levels of education, exam scores or experience beyond the first two years have a significant impact on their quality we will take into account studies that look at the value-added by the teachers. The value added by a teacher is a good measurement of the impact this teacher has on student achievement when correcting for a student's prior test scores (Chetty et al., 2014).

With respect to the adequacy of teacher incentives, we observe mixed evidence. An Indian World Bank-sponsored program in which 500 rural Indian schools were randomly assigned to a group receiving either individual incentives, school incentives, extra resources or nothing (control group) was evaluated by Muralidharan & Sundararaman (2011). They found that students in both school- and teacher-incentivized schools performed significantly better than those in non-incentivized schools. Lavy (2009) examined the effects for Israeli schools that introduced 'tournaments' to evaluate teacher incentives. Teachers that participated were ranked based on value-added contributions to their students' achievement on several exit exams. The monetary incentives for these teachers turned out to significantly improve the performance of their students. The main improvements derived from changes in teaching methods and after-school teaching (Lavy, 2009).

The Israeli tournament provides us with some insights on equity as well. Even though the program was not aimed at increasing adequacy and increasing disadvantaged students' performance specifically, Lavy (2009) concludes that this kind of program can also be aimed at at-risk students to boost their performance. Another teacher merit pay program was organized in Punjabi, Pakistan. In 600 low-scoring primary schools, the teachers were given cash bonuses based on the improvement of test scores, enrollment and exam participation. The reason the program aimed at low scoring schools was because their students did not reach the adequacy standards set by the government. Barrera-Osorio & Raju (2017) found no significant effects on student exam scores, exam participation rates and enrollment in the first and third grade however went up. The program had some positive effects, but students in these schools still scored below the adequate level. With regards to developing countries

a problem for the poorest schools are the high rates of teacher absenteeism. Duflo, Hanna & Ryan (2012) investigate the effects of another teacher incentive program in Rajasthan, India, and find that making the teachers' salaries into a nonlinear function of attendance, decreased teacher absenteeism by 21%, which in turn increased student test scores with 17%.

Using a regression discontinuity design, Springer, Swain & Rodriguez (2016) evaluate another teacher incentive program in Tennessee. The program awarded effective teachers in priority schools (disadvantaged schools) with a 5,000-dollar retention bonus. For teachers of tested subjects, the researchers find a significant positive effect on the retention rate. Keeping highly effective teachers from leaving disadvantaged schools, is as such a way of decreasing the existing inequality among schools.

Between 2000 and 2002 the Californian government offered the Governor's teaching Fellowship. This 20,000 dollar program tried to attract talented teachers to low-performing schools. Steele, Murnane, & Willett (2010) evaluate this program, using an instrumental variable strategy and estimate that acquiring the additional funds, lead to a 28% increase in the chance of teaching in low-performing schools. On top of the increased influx of talented teachers, a relatively small teacher turnover was discovered in teachers that took part in the program.

Overall, teacher incentives, like performance pay, seem to have a significant impact on the presence, attrition and retention of teachers in schools. This type of intervention is per definition more efficient than rewarding every teacher with a higher wage. Rather than focusing on retaining all teachers in disadvantaged schools, the programs aim at retaining and rewarding the most effective teachers. Again, the costs vary depending on the program and as such it is hard to remark on the efficiency of this type of programs.

#### 3.2.4 Group incentives

While financial stimuli for individual teachers might be considered as unethical, group incentives yield all teachers of the same school, or a subset of the teachers in a school, a financial benefit.

We start by discussing the adequacy of the programs. Lavy (2002) discusses the causal effects of low-performing schools that competed with one-another for school bonuses. The schools with the highest year-to-year improvement in test scores received awards, and also the teachers of winning schools benefitted financially. The participating group showed significantly higher year-to-year improvements than a control group. When comparing the efficiency of the school-incentive and the teacher-incentive program, Lavy concludes that the cost per unit gain in the teacher-incentive program dominated that of the school-incentivized program. When considering the causal effects for different subpopulations, Lavy (2002) concludes that the program could also be directed at at-risk students and thus be effectively used for reducing the educational gap. A Texan performance pay program awarded teams of middle school teachers with financial bonuses. The bonuses were decided upon based on the contribution made by the team on the students' test scores. Springer et al. (2012) use a randomized control trial and find that there are no significant effects on either teacher practices or student achievement.

Not only in our systematic review, but in general the empirical evidence on the effects of group incentives is limited. In line with Tirivayi, Maasen van den Brink, & Groot (2014), who wrote a literature review on the subject, we conclude that unlike teacher incentive programs, the effects of group incentive programs are unclear. Further empirical research is needed to be make recommendations about this type of interventions.

### 3.3 Student interventions

#### 3.3.1 Vouchers

While earlier financing policies targeted teachers and schools, an alternative is to focus additional resources on the parents of disadvantaged students. A common practice to provide parents financial resources for education is the use of vouchers (Levin, 2002). Parents are awarded a voucher that covers school expenses such as all or a part of tuition fees. Many of the existing voucher programs have been aimed at increasing equity of the educational system, by providing certain disadvantaged groups with these vouchers. Typically, parents are not obliged to use the voucher but can decide whether or not to use it and in what school. As an underlying mechanism, it is expected that vouchers increase the competition among schools, as schools with better student outcomes are believed to attract more students (Hannaway & Woodroffe, 2004). More recent causal research however points out the lack of evidence for this expected effect in an Italian voucher program (Agasisti, 2011). Evidence on the causal effects of voucher programs on student achievement is mixed. While some studies claim the increase in competition following voucher programs does not lead to substantial efficiency gains in student performance (Ladd, 2002), other studies find a positive effect of vouchers on student performance (Angrist, Bettinger, & Kremer, 2006; Hoxby, 2003; Nechyba, 2000; Peterson et al., 2003).

With respect to equity, literature suggests that vouchers do not reduce educational gaps, nor do they increase equity. As argued by Peterson et al. (2003) poor parents are interested in choice when they are offered. The problem is not that they are not interested, but that, given their limited financial means they are often forced to choose a less optimal solution. Moreover, despite the availability of vouchers, students from unfavorable socio-economic status also more likely to use public school choice options than wealthier families. Voucher systems could integrate neighborhoods, thus changing long term socio-economic differences between populations (Nechyba, 2000). Mills & Wolf (2017) evaluated the Louisiana Scholarship Program. This program provides students with a family-income below 250% of the poverty line, that are attending low-performing schools with school vouchers. These vouchers allow students to enroll in private schools. They find that the use of the program has negatively influenced language and mathematics test scores for the disadvantaged students. This effect however is mitigated in the second year of the program, although still slightly negative. Wolf et al. (2013) evaluated a lottery based voucher program in Washington. The program was specifically aimed at students whose families had a family income of lower than 185% the poverty level. Over 99% of the eligible students were from Hispanic or African-American descent. The aim of the program was to adequately educate these disadvantaged children. Since in the early years the program had too many applicants, a random experimental design is present. The researchers found that the voucher program had a positive effect on the graduation rate of the students. A marginal positive effect on reading scores was also found and no effect on math scores. Similar effects are found by Cullen & Jacob (2005) when evaluating a randomly distributed voucher program in Chicago. They find no real effect on traditional academic measures. The effect on non-educational outcomes such as arrest rates however is significant.

Muralidharan & Sundararaman (2015) investigate the impact of a school choice program that allocated vouchers based on lotteries in India. Two and four years after the start of the program, they find no evidence of any impact on math, languages and science test scores. However, the private schools provided Hindi classes, which public schools did not. As such the program improved the total outcomes of the students and at a significantly lower cost. They find no negative effects on any of the non-participating students, suggesting that the program had no negative external effects.

An alternative way of providing the vouchers is observed in the State of Florida, where vouchers are assigned to parents of children whose school failed to meet accountability tests. This put additional pressure on the lowest-performing schools to improve, which in turn reduced educational inequalities as these schools had a relatively large proportion of disadvantaged students (West & Peterson, 2006). A second alternative way is observed in Chile, which provided vouchers to any student that wished to attend private school in 1981. This increased the private enrollment rate by 20%. While Hsieh and Urquiola (2006) did not observe an increase in average educational outcomes, the program led to more equity for better students, as many of the better students of public schools, now found themselves able to join private schools. As private schools in Chile are allowed to refuse students, they found themselves competing for “better” students, thus leaving “less able” students behind in the public-school system. To decide whether this had an impact on the educational gap, further research is needed (Hsieh & Urquiola, 2006). Angrist, Bettinger, Bloom, King, & Kremer (2002) evaluate a similar large-scale Colombian voucher program. They find that program winners scored higher on test scores and graduated earlier. Moreover, they estimate that the additional cost of 24 dollars per student for the government was severely lower than the gains for the students.

Urquiola (2016), to conclude, provides a literature review on the use of vouchers. First he concludes that in several cases, students’ educational outcomes increase significantly when they switch from public to private schooling. These results, however, are very context dependent. Next he investigates whether large-scale voucher programs for private schools, increase the productivity of public schools. He concludes that, since private schools entry results lead to nonrandom sorting of students, it is not yet possible to make any causal conclusions based on the existing research.

In sum, the large range of results between different programs indicates the contextual impact on the effect of these programs. For this reason, many of the effects attributed to voucher programs could actually describe the effect of private schooling versus public schooling (Cowen, 2012). The positive effect of choosing a higher scoring school on students’ test scores is supported by causal evidence (Hastings & Weinstein, 2008). Even though this is in fact the case, when the voucher program is less expensive than the public schooling of these students, in the context of a superior private schooling network, a voucher program seems like both an efficient and very effective way of increasing the adequacy of education for minority groups. Programs that aim to raise equity, by providing access to more expensive private schools to disadvantaged students, only result in more equality, when the private school system outperforms the public system. As such, in the context of highly segregated education and a qualitative difference between school networks, voucher programs raise both the equity and adequacy of the educational system in an efficient manner.

### 3.3.2 Conditional cash transfer programs (CCT)

Similar to vouchers, conditional cash transfer programs provide transfers to families when they meet certain conditions. While vouchers can only be used for paying tuition fees and school expenses in the strict sense, CCT programs offer monthly cash payments to poor households if their children are enrolled in school.

The adequacy of CCT programs has been widely studied, mainly focusing on the increase of the enrolment rate and daily attendance of students in school. Maluccio & Flores (2005) evaluate the Nicaragua’s Red de Proteccion Social program, where randomly selected beneficiaries into the program are compared to a control group. The program raised enrolment by 17.7%, raised attendance rates by 6.5% and increased daily attendance by 11%. An evaluation of the Mexican Progresa program by Dubois, de Janvry, & Sadoulet (2012) finds positive causal effects of the program on school enrollment.

For performance the results were only significant in primary education and not in secondary education, however. A study on the Bolsa Escola program in Brazil estimates that it increased enrolment by 5.5 to 6.5%, lowered dropout rates and raised grade promotion (Glewwe & Kassouf, 2012). Several studies evaluating similar programs in Honduras, Colombia and Ecuador all found positive, somewhat smaller, effects (Attanasio, Fitzsimons, & Gomez, 2005; Galiani & McEwan, 2013; Glewwe, Olinto, & P, 2004; Schady, Araujo, Peña, & López-Calva, 2008).

With respect to equity, several programs focus on girls' education. One Cambodian study found that the Japan Fund For Poverty Reduction program increased the enrolment and attendance of secondary school girls (Schady & Filmer, 2006). A Bangladeshi study found an increased enrolment for 11-18 year-old girls after a similar CCT program (Khandker, Pitt, & Fuwa, 2003). A Malawi CCT program aimed at adolescent girls, heavily outperformed the effects of the unconditional cash transfer program used as control group on dropout rates (Baird, McIntosh, & Özler, 2011).

Important to note is the existence of conditional cash penalty programs as well. The Learnfare initiative in Wisconsin penalized families welfare grants when their teenage children did not attend school. Dee (2011) finds highly significant positive effects on both school enrollment and attendance rates. As such the program seems to very efficiently reach vulnerable children.

Overall the conditional cash transfer programs seem to perform well. They decrease dropout and increase daily attendance. As most of these programs focus on poor households and seem to increase enrollment and grade advancement rates, we can conclude that conditional cash transfer programs increase both equity and adequacy by funding the poorest families and improving the outcomes of their children. These programs, however, are only interesting for areas facing low enrollment or high absenteeism rates, as the main merit these programs offer is reducing (opportunity) costs from sending children to school. In these areas however, the relatively low costs of CCT programs, especially of the conditional cash penalty programs tied to welfare, turn this type of intervention into an efficient way of reaching the most vulnerable groups.

## 4. Conclusion

Overall, almost none of the discussed interventions are unanimously thought to be either helpful or not. The truth is probably somewhere in between and context dependent. Nevertheless, there seem to be a few interventions that have a rather high success rate when it comes to increasing equity and adequacy. While expensive and only possible up to a certain age, the literature seems to confirm the idea that an increase in mandatory education leads to more equality in education. Both performance pay, and higher teacher wages reduce teacher turnover rate in disadvantaged schools. In the context of highly segregated educational systems and a clear qualitative difference between these networks, voucher programs are highly efficient in raising both equity and adequacy of the educational system. This is not that clear in other contexts. Lastly, the conditional cash transfer programs seem to perform well in decreasing student absenteeism and increasing enrollment rates. While only useful in poorer areas confronted with this type of educational problems, they turn out to be an efficient way of reaching the most vulnerable groups.

Interventions at the school level are highly debated. Reducing class sizes does not seem to be an effective method to increase students' achievements to adequate levels or to raise equality. The proportion of the literature suggesting slightly positive effects is not larger than that suggesting negative effects and the effects on disadvantaged students are not consistently positive. Additional funding for ICT does not seem to have any significant effect on traditional educational outcomes. The

effects on ICT related outcomes however, remain largely unexplored. As such this type of intervention could very well be useful. With regards to raising equal educational opportunities however, the first goal should be to aim for similar outcomes for disadvantaged students as their advantaged counterparts. Increasing the duration or extending daily instruction time within an educational program does not seem to be highly effective. As this type of programs does not seem to have any significant effects on outcomes it is not able to deal with inequality either. While being rather expensive, extending the duration of compulsory education does seem to positively impact both equality and adequacy.

At the teacher level, an intervention that seems effective is one that deals with high teacher turnover. As many disadvantaged schools face higher rates of teacher turnover than their advantaged counterparts, increasing teaching conditions in these schools has been a recent policy in several areas. While the evidence on increasing working conditions is limited, the effects of an increase in wage have been well documented. Higher wages seem to reduce teacher turnover in disadvantaged schools. This is both the case for unconditional higher wage programs and for programs that increase teacher wages based on their performance. When looking at group incentive programs however, this evidence is far from clear. The performance pay approach seems superior, as it does not only reduce the teacher turnover rate, it also ensures that only the most effective teachers are affected by this policy, thus increasing its efficiency.

The effects of interventions aimed at students or their families seem to be highly context-dependent. While voucher programs seem to have positive effects on student outcomes, the measured effects could be the effect of changing to private schools instead. As such, in the context of highly segregated education and a qualitative difference between school networks, voucher programs raise both the equity and adequacy of the educational system in an efficient manner. Conditional cash transfer programs also seem highly effective in increasing student enrollment and decreasing student absenteeism. This however is only relevant for poorer areas, where these programs significantly reduce (opportunity) costs of sending children to school.

It is clear that many of the policy interventions over the past 20 years have limited and mixed effects. Certain hypotheses are interesting starting points for further research. As becomes clear after reading this review, programs in developing countries almost always outperform their counterparts in developed countries. While diminishing scales of return are not necessarily a problem, it might be interesting to investigate in further research the possibility that many developed countries have reached the top of the educational production function. A second hypothesis is that we may simply expect too much from education regarding equality. Socio-economic differences, immigration, cultural differences, ... are all characteristics that students acquired before entering the educational system. While education definitely needs to pay attention to these differences, significant additional gains with respect to educational equal opportunity, should maybe be seen in the broader context of equal opportunities in general.

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