

Chapter 2

Children as Agents of Change for Sustainable Development

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Abstract Children under the age of 15 represented 26 % of the world population (893 million girls, 956 million boys) in 2014. They mainly live in low and middle income countries. Children are exposed to current and future social, economic and environmental sustainability problems, but are also potential agents of change for sustainability, even in childhood. This paper explores how the role of children can be enhanced by transformative education in support of their experiences in discovery, participation, and agency of change. Action-related projects and new information technologies offer opportunities. The tremendous diversity of the living conditions of the world's children (e.g. related to their age, gender, rural/urban, poor/non-poor, cultural contexts, discrimination and marginality), and the types of children's respective sustainability problems need to be considered. Experiences with children's roles as agents of change for sustainability (incl. influence on adults' behavior) are reviewed, based on educational initiatives related to innovation, environmental protection, consumption, health, water and sanitation, and caring for others. Such actions are to be considered as promising public investments in sustainability. Recognition of children's potential role as agents of change implies that concepts of investment in education should not just be guided by human capital formation for life-time earnings in markets and by cultural dimensions, but should be expanded by inclusion of externalities of children's contributions to a sustainable development of societies.

2.1 Introduction

Never before has the world had so many children. Children need protection, must have access to quality education to reach their potential, but children can also play critical roles as agents of change in their families and communities. The latter is the

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focus of this paper.¹ Children's agency is elaborated, and experiences with initiatives of children's active engagement for sustainable development are reviewed. The building of human capital and social capital intersect in education for sustainability and related children's agency. Schools can play key roles not only for children's understanding of sustainability in its local and global dimensions, but also for fostering their active roles in making a difference themselves, throughout childhood and the transition into adulthood.

The number of children in the world has now reached a peak of about 1.9 billion. They represent 26 % of the world population. The absolute number will be about the same in 2050, but then children will make up 21 % of the world population (UN Department for Economic and Social Affairs 2015).

A large share of the world's children live in poverty and will be severely affected by sustainability problems. Can children play a direct role even throughout childhood to address sustainability in its four dimensions, that is, socially, environmentally, economically and culturally? Even if children's contributions were only small on a per child basis, the mere number of the world's children suggests that their role for global advancement of sustainability may become large, provided that children's rights and related programs are facilitated for and with them.

In the past, the potential children might have had to influence their social environment and to generate public goods was neglected and in most parts of the world this still is the case. This paper will focus on the role of the agency of children for development. 'Agency' is understood here as a person's active initiative toward the achievement of a goal, that is, actions undertaken in order to have an impact on someone or something.

Relevant case studies that are globally situated are considered to evaluate the actual scope and identify possible results. Children's potential of making use of their right to participation can be constrained by several factors such as exclusion and inequality. Wealth-based inequality is a global phenomenon. Children need cognitive stimulus to fully unfold their capacities, and this stimulus is often not given in poor households (The World Bank 2015).

To this day, the probability of having less than 4 years of formal education increases if a child is born poor; the term 'education poverty' is used in this context (UNESCO 2010). However, higher household income does not necessarily translate into higher school attendance per se. In low income countries, in which a large share of poor people still rely on agriculture, children often actively participate in the work force. This 'wealth paradox' (Kielland and Tovo 2006) partly explains that school attendance does not linearly increase with household income. This phenomenon can take the shape of a U-curve meaning that, for example, a rural household with a low income will most likely send their children to school because there might be no work for them in the household or on the farm. Increasing income can be associated with a

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higher workload, such that children are required to work, and as a consequence their school attendance will suffer. However, if the household income increases further, the household may rely on more efficient adult workers and labor-saving technology, and send their children to school in view of long-run expected returns on education investments. The wealth paradox can be seen as the tradeoff of opportunity costs. In this context, providing improved school infrastructure and more equipment alone does not have much impact (Banerjee et al. 2007).

Inequalities can also be found between children living in rural areas compared to those living in urban areas. In many low income countries, child labor is a rural phenomenon (Admassie 2003). Children who have to work and go to school often have lower academic scores due to exhaustion. Furthermore, gender inequality is still present especially regarding school attendance in low income countries. The probability of participating in child labor is higher for girls than for boys. In addition, more boys are enrolled in school and thus have the possibility to benefit from more years of education (Ersado 2005). When children do attend school, quality of schooling matters a lot. The conditions of education, which especially poor children are subject to result in sixth grade students in many African countries only reaching a level of literacy and numeracy of 20–30 % of the competence levels expected under more favorable circumstances (SACMEQ 2016).

Given these considerations, the following two questions are addressed:

1. How may the potential of children as catalysts or agents of change for sustainable development be nurtured in responsible ways?
2. How can children's agency for sustainable development be scaled up through education in different settings, especially among the poor?

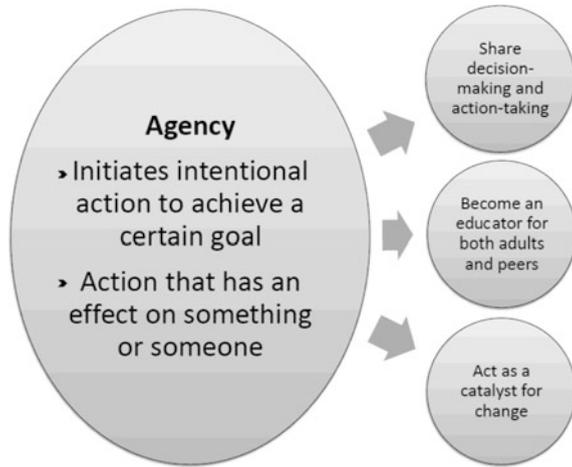
Following this introduction is a section, which provides a brief historical background on the concept of childhood and education. The third section introduces the case studies and the fourth section discusses the potential of information and communications technology (ICT)-based approaches to foster children's agency for sustainability. The fifth section will conclude with implications for policy initiatives to enhance children's agency with education for sustainability.

2.2 Concept of Childhood and of Children's Agency

2.2.1 Defining the Concept's Elements

The debate about children's nature and their potential and right to agency has deep historical and cultural roots. The term 'agency' in this context means that a person actively initiates an action directed towards achieving a specific goal (Fig. 2.1). In other words, a person's action has an impact on someone or something (Reunamo 2009). Agency of children means that they actively take part not only in the process of decision-making but that they are also engaged in the following action-taking

Fig. 2.1 Elements of agency



(Stuhmcke 2012). This could mean that children become educators not only for their peers but also for adults. In this context, children’s role in development is also described as catalytic (Davis 2009).

The concept of *education* is understood as a means of socializing and thus integrating children into society. More specifically, the term ‘education’ refers to the (intrinsic) value of being educated as well as to various learning contents such as knowledge in visual and performing arts or (foreign) language skills. Education can also be viewed as the imparting of a certain value system in order to shape the character of the student. Among such values may be the ideal of maintaining an open heart and mind which, again, would be favorable for continued learning and education. A somewhat similar orientation towards future activities is also given through an education that stresses the importance of responsibilities held by the individual or society as a whole.

Related to the ideal of responsible behavior of society and economy is also the concept of ‘*sustainability*’, a term which was first coined by von Carlowitz (1713/2013) in the context of making forestry environmentally sustainable for the benefit of society. Following the World Commission on Environment and Development (WCED) and its publication of the so-called Brundtland Report (United Nations 1987) as well as the Agenda 21 for Culture (United Cities and Local Governments 2015), sustainable development shall be achieved by taking into consideration the environmental, the social, the economic, and the cultural dimension. Understanding education and rights in this context implies that children and youth should not be exploited for any purposes, but that education means practicing responsible guidance and taking children and their needs and knowledge seriously (UNESCO 2005).

For the first time in the history of UN development goals, the so-called Sustainable Development Goals (SDGs) make explicit reference to children’s agency:

“What we are announcing today – an Agenda for global action for the next fifteen years— is a charter for people and planet in the twenty-first century. Children and young women and men are critical *agents of change* (emphasis added) and will find in the new Goals a platform to channel their infinite capacities for activism into the creation of a better world” (United Nations 2015, § 51).

This statement is expressed merely as a philosophical underpinning in the introductory section “Call for action to change our world”. The actual SDGs and their respective targets appropriately emphasize child health, education, gender inequality, and children’s rights—they do not comprise a concrete goal or target related to children’s agency.

2.2.1.1 Ethical, Religious, and Historical Perspectives

Different world religions and schools of ethics differ in their perspective on the role of children. Christianity emphasizes protecting, respecting, and recognizing children’s spiritual role (Matthew 19:13–14, 18:2–5). A quite remarkable statement can be found in Mark 9:35–37, where Jesus equates a child with his twelve followers, that is, with his agents of change.

In the Jewish tradition, it is the responsibility of the parents or, if they are unable to fulfill this role, that of the community to educate children so that they can live up to their maximum capability and lead a life that is in accordance with Jewish morality and spirituality. In this way, children are recognized as essential and existential to the wellbeing of the community and to the continuance of the Jewish ethnicity, culture, and religion (Rosen 2004).

In Islam, the legal and ethical code defines responsibilities of parents prior to the birth of a child and throughout childhood (Gilandi, 2009). Major emphasis is laid on the importance of education since acquiring knowledge is perceived as a religious duty. Through the educationally-fostered development of children’s intellectual capabilities, children are integrated into their community (Al-Azhar University and UNICEF 2005).

Confucius’ (551?-479? BC) thought on education clearly emphasizes the need for education and study, which he regarded of utmost importance for the (moral) development of men (Riegel 2013).

In modernity, the discourse on education and children’s agency was strongly influenced by philosopher Jean-Jacques Rousseau (1712–1778) who emphasized that children were innately good (Reese 2001) and willing to learn for which reason children should interact with their environment (Palmer et al. 2001). Educational reformer Johann Heinrich Pestalozzi (1746–1827) went one step further and postulated that children should be enabled to help themselves (Pestalozzi 1994). This also implies that older children should help younger children and thus become agents and enablers of change themselves. The philosophy of education developed by Maria Montessori (1870–1952), again, expresses the belief that children should become their own agents of change (Montessori 2013).

Despite this evolving thought on education and children’s agency in Europe, research in the field of environmental education has given only minimal attention to children’s ability to have an impact on their parents’ and other adults’ knowledge and actions (Ballantyne et al. 1998). At the same time, existing studies on environmental education programs indicate that students do share their obtained knowledge with their parents and thereby influence household behavior (Ballantyne et al. 2001). Moreover, research-based recommendations suggest that education for sustainable development should begin early on in children’s educational careers (Davis 2009) as the starting point for lifelong learning on sustainability (Davis et al. 2009).

In this way, the goal of education should be to enhance the commitment and skills of children and youth for the global transition to sustainability (Stuhmcke 2012).

2.2.1.2 Conceptual Framework

Figure 2.2 depicts a framework of children’s agency for sustainability which is based on the above-mentioned concepts and observations. It shows how children, if educated in a stimulating and participatory way, can act as agents of change and thus may have an impact on their family and peers as well as on their entire local community. This impact will ideally foster people’s livelihood and actions towards a sustainable future. If sustainability in all its dimensions is enhanced, this will further influence how children are perceived and treated in the educational sector and society as a whole. In this way, there is an interdependency of teaching sustainability and stimulating children, on the one hand, and children as agents of

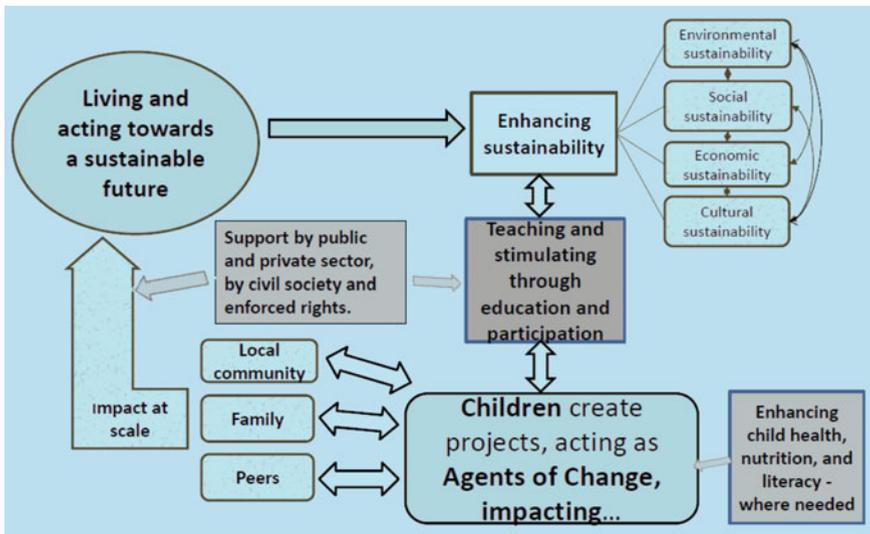


Fig. 2.2 Framework: children’s agency for sustainability

change, on the other hand. However, with regard to the two questions posed above, it is important to notice that children's potential as catalysts for a sustainable development can be nurtured through support on the part of the public and the private sector as well as through a civil society that respects and appreciates children's agency and is ready to enforce children's rights.

There are, however, some basic preconditions that have to be met so that children's agency can unfold (see bottom right of Fig. 2.2). Given that globally one in three children under the age of five are malnourished, improving children's consumption of micronutrients, preventing and treating infections, and fighting stunting in general are basic preconditions for children's agency that must be addressed. Enhancing children's health, nutrition, and literacy is essential. Otherwise, their cognitive capacity is impaired (Hoddinott et al. 2008). Naturally, these measures apply especially in the case of children who would otherwise remain marginalized due to their own or their family's poverty (von Braun and Gatzweiler 2014). Millions of poor children, and homeless street children in particular, exercise agency by being economically active in the informal labor market and in services inside and outside of households. Overcoming this burden is also a precondition for children's agency for sustainability. Fundamentally, childhood needs to be redefined to tap and foster children's potential role as catalysts for sustainability.

2.3 Promising Examples for Children as Agents of Change for Sustainability

Such a redefinition of childhood in favor of children's agency is far from being ubiquitously accepted. Yet there are some positive examples of children-led education and science initiatives, which address one or more of the outlined dimensions of sustainability (see Fig. 2.3). Six of the examples briefly characterized in Fig. 2.3 were chosen as case studies to provide further insight into means of fostering children's agency.

One of the most internationally-present examples of child education regarding environmental change are so-called *Eco-Schools* (Eco-Schools, n.d.). 46,000 schools operate in 58 countries. However, most schools are located in Europe and, compared to the global north, the global south is less represented. The purpose of these institutes of education is to improve the environment of the school itself as well as that of the broader community by empowering students of all age groups. To achieve this goal, children are viewed as decision-makers and they are encouraged to collaborate to attain an environmental improvement of their context. Whereas students from Eco-Schools demonstrate a higher awareness of environmental issues, students' environmental behavior and their preservation values do not seem to be positively influenced by this type of schooling (Boeve-de Pauw and Van Petegem 2013).

	Children's actions	Addressing Sustainability Dimensions			
		Environmental	Social	Economic	Cultural
Child education for environmental change	Eco-schools, multi-country	X			X
	Kindergarten projects, Australia	X			
	Disaster prevention, Philippines	X	X		
Broad-based science education, stimulating children's own actions for science creativity	Kleine Forscher, Germany	X			X
	Jugend forscht, Germany	X			
	United World College	X	X	X	X
Direct and indirect child agency for education, health and nutrition	Health info: Toy effect, Peru		X		
	Barefoot College, India	X	X	X	X
	Iron deficiency, Peru		X	X	
	Agricultural extension by children, Peru		X	X	
	Food for Education, Bangladesh		X	X	
	Drinking Water testing, Ghana	X	X		
	Sanitation Brigade, Bangladesh	X	X		

Fig. 2.3 Review of children-led education and science initiatives related to sustainability

An examination of *child-centered approaches to disaster risk reduction* in El Salvador and the Philippines comes to the conclusion that children actually do take action in favor of risk reduction (Mitchell et al. 2009). In the analyzed contexts, children of all age groups were encouraged to increase their awareness of disaster risk in their community. Children’s agency was expressed in that children were able to influence their parents to act upon, for example, the risk of a landslide threatening to destroy their school.

Stimulating children and youth to take action is also the focus of two broader *science and education initiatives*: Within the context of Germany’s “Jugend forscht” program (Fasse et al. 2015) children and youth from fourth grade (approximately age nine or ten) through young adulthood (age 21) are encouraged to research natural sciences. On a yearly basis, competitions are organized during which awards are given to the best submitted proposals. This approach clearly engages children in decision-making and problem-solving activities and thus views them as valuable agents. Moreover, participants often focus on science as a means to promote sustainability (Fasse et al. 2015).

Barefoot Colleges in India (Barefoot College, 2015) offer education for children from poor families in rural regions of six Indian states. At these colleges, children get to choose their own curriculum (younger children can attend crèches). Covered topics range from solar electrification to livelihood development and thus cover all four dimensions of sustainability. In so doing, Barefoot Colleges serve as community action programs with schools which empower children through attending collaborative classes and working on creative projects (Roy and Hartigan 2008).

Children’s agency in the context of health, nutrition, and agriculture was also confirmed through two research and action initiatives conducted in Peru and Ghana,

respectively. The research project located in Peru examined to which extent health information regarding livestock transmitted diseases and disease prevention provided to children (age 6–17) had an influence on their parents' actions (Maruyama et al. 2012). Indeed children were found to act as vectors that stimulated health conscious behavior in their fathers. In this way, children's agency can foster the quality and extension of treatment opportunities.

Strengthening children's agency through access to technology that enhances their roles in their communities is a growing opportunity, as certain technologies become more affordable. An example of the positive influence of available technology on children's agency was realized within the scope of the research project: Ghanaian youth from age 12–16 were trained in their school context on sophisticated water testing equipment to assess the water quality of their households (Okyerere et al. 2015). Results showed that children equipped this way educated other household members on hygiene problems and on how to keep drinking water clean at home and in the field. Thus, in the context of this research project, acknowledging children's agency improved the quality of drinking water.

2.4 Fostering Children's Agency Through ICT

Information and communications technologies (ICT) change the context of social and economic development (Torero and von Braun 2006). This also applies to the role children take in relation to their community.

In this way, an approach to strengthen the agency especially of marginalized children may be to improve their access to ICT. Various projects and research initiatives draw a rather heterogeneous picture of the feasibility and impact of such approaches. This heterogeneity is likely due to differences in the quality of the provided software and the exact setting in which ICT was integrated into school education (Murnane and Ganimian 2014; Light 2016).

The perhaps most broadly known of these projects is the One Laptop Per Child (OLPC) concept established by Nicholas Negroponte and presented at the World Economic Forum in Davos, Switzerland, in January 2005. The OLPC project attempted to distribute to poor schoolchildren up to 15 million low-cost laptops annually as of the end of 2007 in order to give marginalized children access to software and information that would increase their self-dependent learning. Negroponte's vision may still be ahead of its times, and he has so far been unable to fully meet this ambitious goal regarding the mere distribution of the laptops as well as their actual impact on children's learning (Kraemer et al. 2009). An evaluation of the OLPC program conducted in Peru, for example, came to the conclusion that children's basic computer skills increased but that the access to ICT in school did not have an effect on literacy- and numeracy-related test scores. Yet general cognitive skills were positively affected (Cristia et al. 2012). Another evaluation

assessed the impact of the OLPC program on migrant children in China. Here, the program not only improved children's basic computer skills but also increased their math test scores. However, in this specific context children were entitled to take the laptops home and the devices provided for software that directly supported the math contents covered in class. Furthermore, this evaluation observed that participating in the OLPC program improved children's self-esteem (Mo et al. 2013).

Other studies evaluated the impact of computer-assisted learning (CAL) in India. Linden (2008) found that CAL was only supportive to children's learning if offered as an additional out-of-school activity, whereas if used to substitute for regular classes student's performance in math tests decreased. Then again, Banerjee et al. (2007) assessed the impact of a 2-year CAL program which was offered as a mixed in-class-out-of-class approach on students' mathematical skills and came to the conclusion that children's test scores increased. However, the CAL program was more expensive than the tutoring program "Balsakhi", a remedial education intervention in the context of which a young adult from the local community serves as a tutor for children in second, third, and fourth grade who have fallen behind their peers with respect to basic numeracy and literacy skills. Yet another research initiative (Mitra and Dangwal 2010) found that marginalized school children in India benefited from self-dependent group learning with a computer with internet access and that this effect on their test scores was further enhanced by contact to local or online mediators.

Other ICT programs like "mJangle" (SenMobile 2015) rely on the broad distribution of smart phones in Africa and in so doing aim to improve pre-school and primary education of marginalized children via Apps. Yet other programs use interactive radio instruction to compensate for a lack of qualified pre-school teachers in rural and urban environments (Hinostrroza et al. 2014).

This brief overview shows that there is a variety of small- and large-scale ICT projects and research initiatives. Nevertheless, there remains a lack of systematic impact evaluations and an aggregation of the findings on a meta-level (Hinostrroza et al. 2014). Furthermore, on a practical level, the issue of availability of basic hardware from access to electricity to a reliable Internet connection (Light 2016.) has to be tackled and the privacy protection of children has to be secured (Kelly 2013). These constraints are probably going to be overcome in coming years. The potential of ICT projects goes far beyond in-school test scores: Literacy and numeracy are of great importance in lifting poor children out of their marginalized situation and pave the way to higher science education and related empowerment. Research also indicates that ICT used in a non-formal setting may improve the agency of children on a much broader scale and help to overcome the gender gap prevalent in access to information and learning materials (Kozma 2005). Giving children access to ICT may allow them to increase their agency for sustainability virtually on their own. Moreover, it may permit children to inter-connect with each other globally, and thereby, for instance, bring locally isolates sustainability initiatives to scale.

2.5 Implications for Education Policy and Sustainability Actions

Seeking sustainability within the 2030 Agenda for Sustainable Development (2015), that is, “[making] development sustainable to ensure that it meets the needs of the present without compromising the ability of future generations to meet their own needs” (United Nations 1987), could already be interpreted as a mandate to give those a voice who are directly affected by the future, namely the children. It is within this context that responsible enhancement of children’s agency has to be considered.

Various education and science initiatives around the world have already integrated children’s roles as agents of change. They provide evidence that children, indeed, have the potential to be catalysts for enhanced sustainability in their local environment and beyond. Throughout history the perception and role of children have been subject to change. It may, again, be time to redefine childhood and the role of children both in today’s society and for future generations. This does not necessarily mean breaking with long-standing religious and philosophical traditions of the meaning of “childhood”. However, with new and emerging technology and inter-connectedness among children, they themselves may be about to redefine their childhoods.

From the above review of small and large initiatives, the following implications for action and policy support shall be highlighted:

1. *Invest in poor children’s preconditions for agency*: in order to have the capacity to function as agents of change, children’s living conditions need to be improved to meet certain standards regarding their health and nutritional status. Marginalizing factors such as poverty, gender inequality, illiteracy, and child labor have to be overcome.
2. *Strengthen the role of research on children’s agency*: through experimental designs and impact analysis of existing initiatives, scientific research can identify best fits of enhanced children’s agency in diverse (school) contexts. Obviously, experiments with children need to follow strict ethical standards of informed consent etc.
3. *Sharing experiences with child agency worldwide*: the accessibility of knowledge obtained through research and practical experience should be increased through social media in order to enable people to learn from example. Children as agents of change have to be part of this process.
4. *Facilitating a web-based global platform on which children can meet* and share their experience about sustainability related projects would be of great importance. The examples of the children-led education and science initiatives clearly show the potential of children and youth as agents of change. Yet the selective initiatives need scaling up. School systems could facilitate such platform opportunities, as many school children do not yet have web access.

References

- Admassie, A. (2003). Child labour and schooling in the context of a subsistence rural economy: Can they be compatible? *International Journal of Educational Development*, 23(2), 167–185.
- Al-Azhar University, & UNICEF. (2005). *Children in Islam: Their care, development and protection*. Available via UNICEF. http://www.unicef.org/mena/Children_in_Islam_English.pdf. Accessed February 16.
- Ballantyne, R., Connell, S., & Fien, J. (1998). Students as catalysts of environmental change: A framework for researching intergenerational influence through environmental education. *Environmental Education Research*, 4(3), 285–298.
- Ballantyne, R., Fien, J., & Packer, J. (2001). Program effectiveness in facilitating intergenerational influence in environmental education: Lessons from the field. *The Journal of Environmental Education*, 32(4), 8–15.
- Banerjee, A. V., Cole, S., Duflo, E., & Linden, L. (2007). Remedying education: Evidence from two randomized experiments in India. *The Quarterly Journal of Education*, 122(3), 1235–1264.
- Barefoot College. (2015). *Barefoot College*. <http://www.barefootcollege.org>. Accessed February 18, 2016.
- Boeve-de Pauw, J., & Van Petegem, P. (2013). The effect of eco-schools on children's environmental values and behaviour. *Journal of Biological Education*, 47(2), 96–103.
- Cristia, J. P., Ibararán, P., Cueto, S., Santiago, A., & Severín, E. (2012). *Technology and child development: Evidence from the one laptop per child program*. IZA Discussion Paper 6401, pp. 1–40.
- Davis, J. (2009). Revealing the research “hole” of early childhood education for sustainability: A preliminary survey of the literature. *Environmental Education Research*, 15(2), 227–241.
- Davis, J., Engdahl, I., Otieno, L., Pramling-Samuelson, I., Siraj-Blatchford, J., & Vallabh, P. (2009). Early childhood education for sustainability: Recommendations for development. *International Journal of Early Childhood*, 41(2), 113–117.
- Eco-Schools. (n.d.). *Eco-Schools Global*. <http://www.ecoschools.global/>. Accessed February 18, 2016.
- Ersado, L. (2005). Child labor and schooling decisions in urban and rural areas: Comparative evidence from Nepal, Peru, and Zimbabwe. *World Development*, 33(3), 455–480.
- Fasse, S., Gaide, P., Kindel, C., Kraft, N., von Polier, X., Reimann, A., et al. (2015). *Passion Zukunft: Blick zurück nach vorne: 50 Jahre Jugend forscht: Das Jubiläumsmagazin 2015*. Available via Jugend forscht. http://www.jugend-forscht.de/fileadmin/user_upload/50_Jahre/Jubilaeumspublikation_Passion_Zukunft_final.pdf. Accessed February 18, 2016.
- Gilandi, A. (2009). Islam. In D. S. Browning & M. J. Bunge (Eds.), *Children and childhood in world religions: Primary sources and texts* (pp. 151–216). New Brunswick, NJ: Rutgers UP.
- Hinojosa, E. J., Isaacs, S., & Bougroum, M. (2014). Information and communications technologies for improving learning opportunities and outcomes in developing countries. In D. A. Wagner (Ed.), *Learning and education in developing countries: Research and policy for the post-2015 UN development goals* (pp. 42–57). New York: Palgrave Macmillan.
- Hoddinott, J., Maluccio, J. A., Behrman, J. R., Flores, R., & Martorell, R. (2008). Effect of a nutrition intervention during early childhood on economic productivity in Guatemalan adults. *The Lancet*. [http://dx.doi.org/10.1016/S0140-6736\(08\)60205-6](http://dx.doi.org/10.1016/S0140-6736(08)60205-6). Accessed February 2008.
- Kelly, A. (2013). *Technology can empower children in developing countries—If it's done right*. Available via The Guardian. <http://www.theguardian.com/sustainable-business/technology-empower-children-developing-countries>. Accessed February 16, 2016.
- Kielland, A., & Tovo, M. C. (2006). *Children at work: Child labor practices in Africa*. Boulder CO: Lynne Rienner.
- Kozma, R. B. (2005). Monitoring and evaluation of ICT for education impact: A review. In D. A. Wagner, B. Day, T. James, R. B. Kozma, J. Miller, & T. Unwin (Eds.), *Monitoring and*

- evaluation of ICT in education projects: A handbook for developing countries* (pp. 11–20). Washington, DC: InfoDev/World Bank.
- Kraemer, K. L., Dedrick, J., & Sharma, P. (2009). One laptop per child: Vision vs. reality. *Communications of the ACM*, 52(06), 66–73. doi:10.1145/1516046.1516063
- Light, D. (2016). *Technology, teaching and learning*. Available via UNICEF: The State of the World's Children 2015: Imagine the Future. <http://sowc2015.unicef.org/stories/a-technology-ecosystem-to-support-learning/>. Accessed February 17, 2016.
- Linden, L. L. (2008). *Complement or substitute? The effect of technology on student achievement in India*. Working Paper, Columbia U, pp. 1–46.
- Maruyama, E., Torero, M., & Viceisza, A. (2012) *The toy effect: Children's influence on parental behavior: Experimental evidence from Perú*. Available via WebMeets. <http://www.webmeets.com/files/papers/LACEA-LAMES/2012/612/maruyama-torero-viceisza-toy%20effect-2012.pdf>. Accessed February 17, 2016.
- Mitchell, T., Tanner, T., & Haynes, K. (2009) *Children as agents of change for disaster risk reduction: Lessons from El Salvador and the Philippines*. Working Paper 1, pp. 1–47.
- Mitra, S., & Dangwal, R. (2010). Limits to self-organising systems of learning—The Kalikuppam experiment. *British Journal of Educational Technology*, 41(5), 672–688.
- Mo, D., Swinnen, J., Zhang, L., Yi, H., Qu, Q., Boswell, M., et al. (2013). Can one-to-one computing narrow the digital divide and the educational gap in China? The case of Beijing Migrant Schools. *World Development*, 46, 14–29.
- Montessori, M. (2013). *Durch das Kind zu einer neuen Welt, herausgegeben, textkritisch bearbeitet und kommentiert von Harald Ludwig: Gesammelte Werke* (Vol. 15). Freiburg: Herder.
- Murnane, R. J., & Ganimian, A. J. (2014). *Improving educational outcomes in developing countries: Lessons from rigorous evaluations*. NBER Working Paper Series 20284, pp. 1–57.
- Okyere, C. Y., Pangaribowo, E. H., Asante, F. A., & von Braun, J. (2015). *The impacts of household water quality testing and information on safe water behaviors: Evidence from randomized experiment in Ghana*. Available via Center for Development Research (ZEF). http://www.zef.de/fileadmin/webfiles/downloads/projects/watsan/CYO_London_Conference_Version_1.pdf. Accessed May 25, 2016.
- Palmer, J., Bresler, L., & Cooper, D. E. (2001). *Fifty major thinkers on education: From confucius to Dewey*. London: Routledge.
- Pestalozzi, J. H. (1994). *Wie Gertrud ihre Kinder lehrt: Ein Versuch den Müttern Anleitung zu geben, ihre Kinder selbst zu unterrichten, in Briefen*. Bad Heilbrunn: Klinkhardt.
- Reese, W. J. (2001). The origins of progressive education. *History of Education Quarterly*, 41(1), 1–24.
- Reunamo, J. (2009). The agentive role of children's views in sustainable education. *Journal of Teacher Education for Sustainability*, 8(1), 68–79.
- Riegel, J. (2013). *Confucius*. Available via The Standard Encyclopedia of Philosophy. <http://plato.stanford.edu/archives/sum2013/entries/confucius/>. Accessed February 16, 2016.
- Rosen, D. (2004). *How children are valued in the Jewish tradition*. Available via Rabbi David Rosen. <http://www.rabbidavidrosen.net/Articles/Judaism/How%20Children%20are%20Valued%20in%20the%20Jewish%20Tradition%20Oct%2004.doc>. Accessed February 16, 2016.
- Roy, B., & Hartigan, J. (2008). Empowering the rural poor to develop themselves: The barefoot approach. *Innov*, 3(2), 67–93.
- SACMEQ. (2016). *Reading & math achievement scores*. Available via SACMEQ: The Southern and Eastern Africa Consortium for Monitoring Educational Quality. <http://www.sacmeq.org/ReadingMathScores>. Accessed February 16, 2016.
- SenMobile. (2015). *An after school program in literacy, math, foreign languages and technologies for kids in Africa*. Available via mJangle. <http://www.mjangle.com/en/#>. Accessed February 18, 2016.
- Stuhmcke, S. (2012). *Children as change agents for sustainability: An action research case study in a Kindergarten*. Ph.D. thesis, Queensland University of Technology. Available via http://eprints.qut.edu.au/61005/1/Sharon_Stuhmcke_Thesis.pdf. Accessed May 25, 2016.

- The World Bank. (2015). *World development report 2015: Mind, society, and behavior*. Available via <http://www.worldbank.org/content/dam/Worldbank/Publications/WDR/WDR2015/WDR-2015-Full-Report.pdf>. Accessed February 16, 2016.
- Torero, M., & von Braun, J. (Eds.). (2006). *Information and communication technology for development and poverty reduction: The potential of telecommunications*. The Johns Hopkins UP for IFPRI, Baltimore, MD. Available via http://www.ifpri.org/sites/default/files/publications/information_and_communication_technologies_for_development_and_poverty_reduction_the_potential_of_telecommunications.pdf. Accessed February 18, 2016.
- UN Department for Economic and Social Affairs. (2015). *World population prospects: The 2015 revision, key findings & advance tables*. Working Paper ESA/P/WP.241. Available via http://esa.un.org/unpd/wpp/publications/files/key_findings_wpp_2015.pdf. Accessed February 16, 2016.
- UNESCO. (2005). *UN decade of education for sustainable development: 2005–2014*. Available via UNESCO. <http://unesdoc.unesco.org/images/0014/001416/141629e.pdf>. Accessed May 25, 2016.
- UNESCO. (2010). *EFA global monitoring report 2010: Education for all: Reaching the marginalized*. Available via UNESCO. <http://unesdoc.unesco.org/images/0018/001866/186606E.pdf>. Accessed May 25, 2016.
- United Cities and Local Governments. (2015). *Culture 21: Actions*. Available via Amenda 21 for Culture. http://agenda21culture.net/images/a21c/nueva-A21C/C21A/C21_015_en.pdf. Accessed May 25, 2016.
- United Nations. (1987). *World commission on environment and development report of the world commission on environment and development: Our common future*. Available via UN Documents. <http://www.un-documents.net/our-common-future.pdf>. Accessed February 16, 2016.
- United Nations. (2015). *Transforming our world: The 2030 agenda for sustainable development, A/RES/70/1*.
- von Braun, J., & Gatzweiler, F. (Eds.). (2014). *Marginality—Addressing the nexus of poverty, exclusion and ecology*. Dordrecht: Springer. doi:10.1007/978-94-007-7061-4
- von Carlowitz, H.-C. (1713/2013). *Sylvicultura oeconomica oder Haußwirthliche Nachricht und Naturmäßige Anweisung zur wilden Baum-Zucht (ed Hamberger J)*. München: Oekomverlag.



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