Journal of Environmental Psychology 80 (2022) 101777

Contents lists available at ScienceDirect

Journal of Environmental Psychology

journal homepage: www.elsevier.com/locate/jep

# From theory to action: Explaining the process of knowledge attitudes and practices regarding the use and disposal of plastic among school children

César Salazar [a,*], Marcela Jaime [b], Mauricio Leiva [c], Nuria González [d]

[a] Departmento de Gestión Empresarial, Facultad de Ciencias Empresariales, Universidad del Bío-Bío, Research Nucleus on Environmental and Natural Resource Economics (NENRE)-EfD Chile, Centro de Estudios de Ñuble (CEÑ) and Interdisciplinary Center for Aquaculture Research INCAR, Chile
[b] Escuela de Administración y Negocios, Universidad de Concepción, Research Nucleus on Environmental and Natural Resource Economics (NENRE) EfD-Chile and Centre of Applied Ecology and Sustainability CAPES, Chile
[c] Facultad de Ciencias Económicas y Administrativas, Universidad Católica de la Santísima Concepción Chile, Research Assistant Nucleus on Environmental and Natural Resource Economics (NENRE)-EfD, Chile
[d] Research Assistant Nucleus on Environmental and Natural Resource Economics (NENRE)-EfD, Chile

ARTICLE INFO

Handling Editor: W. Schultz

*JEL classification:*
Q53
A21
D64

*Keywords:*
KAP
Plastic pollution
Transmission
School children

ABSTRACT

Environmental education is regarded as a key instrument for promoting pro-environmental behavior in early childhood. In this paper, we analyze the transmission process within a personal value system including knowledge, attitudes, and practices (KAP) regarding the consumption and disposal of plastics among school children, and the extent to which parents play a role in mediating that transmission. The study gathers data from a sample of 1,521 children in southern Chile. Results evidence that the transmission of value systems is a recursive and hierarchical process, where knowledge mediates attitudes, and attitudes (and knowledge) mediate practices. We also find evidence that parents' behavior significantly explains children's behavior in all domains of KAP, with stronger connections among practices where children and parents interact more closely (e.g., packing a lunch box) and in those that are more visible to children (e.g. recycling).

## 1. Introduction

Global plastic production and use has increased exponentially since the 1950s, reaching over 320 million tons in 2015 (FAO, 2017). The largest market sector for plastic resins is packaging (Jambeck et al., 2015), and, given the growing market demand for plastic products, production is expected to increase even further, exceeding 1 billion tons by 2050 (FAO, 2017). Plastics in the marine environment are of increasing concern because of their persistence and effects on the oceans, wildlife, and, potentially, humans (Jambeck et al., 2015). An estimated 150 million tons of plastics have accumulated in the world's oceans, and the problem has been compounded by overloaded waste management and recycling systems that are unable to cope with rising plastic production (Tessnow-von Wysocki et al., 2019). Marine plastic pollution has consequences on the environment and biodiversity, as well as industries including tourism, shipping and fishing, and it represents a potential risk for food security and human health (Barboza et al., 2018).

Because marine plastic pollution is a global issue with local origins, tackling this problem requires a combination of policy instruments that target the behavior of both producers and consumers of plastic (Alpizar et al., 2020). A suitable policy instrument that has received increased attention for mitigating plastic pollution recently is education (Cordier et al., 2021). Although this instrument can be universally administrated to incentivize positive and long-lasting changes in behavior, it becomes particularly important in early childhood, where individuals are forming their personal value systems, as opposed with adulthood, when good/-bad habits have been established (Fehr et al., 2013; Sutter et al., 2019; Verplanken, 2018; Verplanken & Orbell, 2019; Verplanken & Whitmarsh, 2021; Wood & Rünger, 2016). Children could receive information on the causes and consequences of (marine) plastic pollution at school. Being better informed about plastic pollution could also help mediate the children's perceptions and attitudes, which could translate into changes in behavior in the form of concrete practices (Hartley et al., 2015, 2018; Hoang and Kato, 2016; Owens, 2018). In turn, these effects

* Corresponding author.
*E-mail addresses:* csalazar@ubiobio.cl (C. Salazar), mjaime@udec.cl (M. Jaime), mleivade@gmail.com (M. Leiva), nuria.gonzalezvallejos@gmail.com (N. González).

https://doi.org/10.1016/j.jenvp.2022.101777
Received 9 June 2021; Received in revised form 11 February 2022; Accepted 13 February 2022
Available online 15 February 2022

could be reinforced or counteracted by the cognitive, affective, and behavioral components of parents' and caregivers' personal value systems because of the influence those adults exert over the children (Katz-Gerro et al., 2020; Ando et al., 2014; Matthies et al., 2012). One of the main channels through which values and behavior of parents are transmitted to children is through their affective bond. Estrada et al. (1987) indicate that affective relationship between children and parents could influence cognitive growth by improving their flow of information, promoting joint problem solving, and affecting children's exploratory tendency, which in turn determine their willingness to approach and persist in tasks. Similarly, Stack et al., (2010) point out that affective bond between children and parents influence children's cognitive and emotional development, which could also affect their outcomes over their lifespan. Based on this literature, children with strong affective bonds could be more likely to discuss and understand the consequences of environmental problems, and to develop interest in being part of the solution. Another channel that could explain intergenerational transmission of behavior is through the normative and behavioral aspects of parents (i.e., parents' behavior and/or children's perceptions of parents' behavior). Whitbeck and Gecas (1988) find that the strongest predictor of parent-child values congruence is the accuracy of children's prediction of parents' socialization values.[1] This implies that children's awareness of the values their parents are attempting to socialize have the potential of influencing the importance they give to given problems. In the environmental domain, there is ample evidence of the extent to which parents' socialization influence the behavior of adolescents in areas such as responsible waste disposal, consumption of environmentally friendly products, and energy-saving activities (Grønhøj & Thøgersen, 2009). Grønhoj and Thøgersen (2012) evaluate whether pro-environmental behavior of adolescents is the outcome of their own pro-environmental attitudes or the product of social influence within the family, finding evidence that their behavior is heavily influenced by the dominating norms within the family, and in particular by how strongly they are manifested in their parents' behavior. Similar results are found in Grønhøj and Thøgersen (2017). More recent work has been devoted to understand the emergence of pro-environmental behavior among children and to which extent it relates to the influence of their parents. This literature evidences that parent's behavior affects that of their children both directly and through subjective norms, and this result holds regardless of cultural differences (Ando et al., 2014). In a related study, Katz-Gerro et al. (2020) find that pro-environmental behavior of children (i.e., sustainable lifestyle, reducing consumption, and reducing impact) in a group of countries is explained by both parental environmental behavior and socialization between children and parents. Finally, observed behavior of parents has also shown to have the potential of generating long-lasting changes in the behavior of children (Evans et al., 2018).

This paper analyzes the transmission process of the cognitive, affective, and behavioral dimensions of school children's personal value systems (i.e., knowledge, attitudes, and practices, hereinafter KAP) in relation to the consumption and disposal of plastics. We hypothesize that transmission occurs in a recursive and hierarchical process, departing from knowledge (i.e., theory) to the adoption of practices that could help counteract the negative effects of plastic pollution (i.e., action). We are also interested in exploring the extent to which this process is mediated by children's own values, or through the influence of their parents. Because parents can be considered role models for children, they have the potential to influence children's behavior in various ways. Our contribution to the literature is twofold: First, this paper contributes to expand scientific literature about how knowledge is transmitted to practices within the child personal value system in the context of global environmental problems and educational environments. Although the KAP model has been widely used to examine this transmission in many areas and populations, the literature is more limited in the area of sustainability in general, and among school children populations in particular (Salas-Zapata et al., 2018). This is important since environmental issues can be understood as a collective problem where responsible behavior towards others and cooperation are key to provide solutions. Second, even though the influence of parents on children's behavior in the environmental domain is well documented in the literature, previous estimations of this association rely mostly on how attitudes influence behavior (Leppänen et al., 2012; Meeusen, 2014; Casaló & Escario, 2016; Collado et al., 2017), while casual effects of parent-children interactions are rather limited (Katz-Gerro et al., 2020; Matthies et al., 2012). In this paper, we adequate the KAP model by incorporating parents' influence in the process of transmission from knowledge, attitudes to practices (behavior) within the child value system. This model has the advantage of comprising not only the affective (attitudes) but also the cognitive (knowledge) mechanism stated in the literature.

The rest of the paper is organized as follows: Section 2 summarizes the empirical evidence on the transmission process of knowledge, attitudes, and practices among school children and proposes a hierarchical model of behavior. Sections 3 present the material and methods, including the data and estimation framework, respectively. Section 4 analyzes the main results. Section 5 provides discussion and implications of results, and section 6 summarizes the main conclusions of the study.

## 2. Transmission of knowledge, attitudes and practices

### 2.1. Empirical evidence

Although there is extensive literature devoted to analyzing the pro-environmental behaviors and attitudes of adults (Blankenberg & Alhusen, 2019; Collado et al., 2017; Schultz and Kaiser, 2012, pp. 556–580; Turaga et al., 2010; Fujii, 2006; Clark et al., 2003; Garling et al., 2003; Gutierrez-Karp, 1996; Lévy-Leboye et al., 1996), little is known about the emergence of these values in early life. There is a strand of literature examining the determinants of pro-environmental behavior among children. Evidence indicates that environmental education, time spent in nature, closeness to nature, and restorative experiences linked to the renewal of resources are positively linked to pro-environmental behavior (Chawla & Derr, 2012; Cheng & Monroe, 2012; Collado & Corraliza, 2015). Despite this literature providing important insights into the drivers of pro-environmental behavior, the questions of what mechanisms can explain the transmission of it in the children's personal value system, and how parents influence children along cognitive, affective, and behavioral dimensions remain unanswered (Collado et al., 2017). Previous literature has studied this transmission process by exploring the question about how parents' attitudes influence children's behavior. This is based on a potential intergenerational transmission of environmental values from parents to children. The starting point for this theory is that the family, as a result of the socialization processes, generate long-term interpersonal influence across generations (Acock & Bengtson, 1980; Guastello and Peissig, 1998). Thus, the socialization theory points out that in early childhood the family is the strongest socialization agent (Maccoby, 2007). Empirical work reveals a positive parent-child association between environmental attitudes/concerns and behavior toward nature and the environment, in general (Leppänen et al., 2012; Meeusen, 2014; Casaló & Escario, 2016; Collado et al., 2017) and regarding resources consumption, in particular (Grønhøj & Thøgersen, 2009). An important mechanism that is left out in these studies is knowledge. Matthies et al. (2012) suggest that parents seem to influence their children's pro environmental behavior not only through

[1] The psychology literature defines the concept of socialization as "the processes by which young people are taught the necessary skills, values, and behavioral patterns to become well-functioning members of their social group (s), and the culture in which they live". This process is also associated with the emergence of good habits (Maccoby, 2007).

their own behavior but also by communicating knowledge of the problem.

An alternative approach to investigate the intergenerational transmission process is the KAP model of behavior, originated in learning theory (Bandura, 1986). According to Salas-Zapata et al. (2018), this model has the advantage of unifying not only the affective (attitudes) and behavioral factors but also the cognitive (knowledge) mechanism that are subject to intervention from communicative actions. Thus, *knowledge* refers to the cognitive elements associated with mental actions such as perception, memory, learning, and prediction during the processing of information. A*ttitudes* are affective responses to an object and depend on beliefs, values, personal experiences, encounters with others, the processes of socialization and, in general, direct or indirect contact with reality (Bohner & Wanke, 2002; Donahue & Miller, 2006). Finally, *practices* denote specific actions directly related to cognitive (knowledge) and affective (attitudes) processes (Heimlich and Ardoin, 2008).

The KAP model has been widely used to examine the transmission of knowledge, attitudes, and practices in areas such as health, pain management, nutrition, accident prevention, amoral health (see, e.g., Smyth et al., 2017; Wan et al., 2016; Liu et al., 2018; Alzghoul and Abdullah, 2015). In the environmental domain, evidence is somehow limited, being mainly applied to climate change and sustainability issues (Gadzekpo et al., 2018; Karami et al., 2017). Salas-Zapata et al. (2018) conducted a systematic review to identify and analyze KAP studies on sustainability during the period 1990–2016. Surprisingly, only one out of ten studies targeted children attending primary schools, whereas half of them were devoted to populations in educational environments (i.e., teachers, students and graduates). The topics analyzed in these studies relate mainly with environmental conservation (e.g., ecosystems, natural resources, and environmental protection), being marine plastic pollution an unexplored area.[2]

Even though the knowledge mechanism is commonly left out in empirical applications of the intergenerational transmission approach, some studies using the KAP model find that parents' characteristics such as education are relevant to explain environmental attitudes (Pe'er et al., 2007), and environmental knowledge of students (Alp et al., 2008). Within the student's value system, Levine and Strube (2012) showed that environmental knowledge was not significantly related to attitudes, attitudes were strongly related to intentions, and intentions fully mediated the influence of attitudes on behavior. This suggests that knowledge about the environment and attitudes influence behavior through different pathways, which may have implications for interventions that seek to increase ecological behavior.

Although evidence has shed light on the important role parents have on children's pro-environmental behavior, very little attention has been devoted to the potential influence of the different dimensions of parents' KAP on children's behavior. In the following section, we propose a conceptual framework that allows analyzing the (potential) transmission process from knowledge to action. This model can simultaneously explain the connection among the different dimensions of children's KAP and also take into account the potential effects that parents' KAP may have on the children's KAP. This model, provides us a way of explaining the behavioral and contextual factors that drive children's behavior.

### 2.2. From theory to action: A hierarchical model of behavior

To illustrate the underlying mechanism through which theory is transformed into action, we follow the KAP model that assumes a hierarchical model that posits a learning model of behavior change in which knowledge precedes attitudes, which in turn influences behavior. Thus, this model presumes a relative ordering of knowledge, attitudes, and practices (KAP) (Valente et al., 1998), suggesting that causality follows a transmission from lower to higher dimensions of environmental commitment. These dimensions in turn encompass increasing levels of individuals' environmental commitment. This is true at the intrapersonal level. In other words, children's knowledge is not expected to be affected by their own attitudes because knowledge is either taught or acquired directly by children through their surrounding environment. A similar reasoning can be applied in the case of attitudes, and practices. Our assumption is that this pattern replicates at the interpersonal level, being children's knowledge not expected to be affected by parents' attitudes and practices. Similarly, children's attitudes are assumed to be independent on parents' practices However, this may be not totally true as attitudes may be shaped through the example (i.e., practices) observed from significant others. Although we do not allow for this possibility in our conceptual model below, this association will be empirically tested in the results section.

The process initiates with the acquisition of knowledge ($K_c$), which depends on contextual factors that are crucial to the emergence of a suitable learning environment, as depicted in equation (1):

$$K_c = f(K_p,\ X) \tag{1}$$

We assume two categories of contextual factors that can enhance the learning of pro-environmental behavior. The first one relates to the parents' knowledge of the causes and consequences of marine plastic pollution ($K_p$). Following the intergenerational transmission theory discussed in section 2.1, we adapted the KAP model to allow parents to exert influence on their children. From equation (1), our hypothesis is that parents' specific knowledge on marine plastic pollution influence positively children's knowledge on the same topic (with $f_{K_p} > 0$). Second, as discussed previously, variables such as time spent in nature, closeness to nature and restorative experiences linked to the renewal of resources may be positively linked to pro-environmental behavior. Thus, we consider a set of contextual factors, embedded in $X$, including school (e.g., environmental certification), neighborhood and commune characteristics (e.g., coastal versus non-coastal communes, being exposed to waste in the surroundings, etcetera); therefore, the sign of the function $f_x$ will depend on each characteristic.

The process continues when the cognitive dimension is transferred into the affective dimension, incentivizing the emergence of attitudes. This relation is depicted in equation (2):

$$A_c = g(K_c(K_p), A_p, S) \tag{2}$$

In our behavior model, attitudes regarding the causes, consequences, and potential solutions to marine plastic pollution are mediated by three possible channels. First, attitudes can be the result of the knowledge acquired by the children themselves ($K_c$), either directly (i.e., through schooling or because of their positive/negative experience with this problem in their daily lives) or indirectly (i.e., as a result of parents communicating knowledge of the problem to their children, $K_p$). Our hypothesis is that knowledge has a positive effect on attitude within the child's value system ($g_{K_c} > 0$). Because of their influence as role models, parents' attitudes ($A_p$) can also shape the way children perceive this problem, affecting the children's attitudes. We hypothesized that parents' attitudes exert a positive effect on children's attitudes ($g_{A_p} > 0$). Finally, children's attitudes could also be the result of past experiences with (or information received about) environmental issues, in which case $g_S > 0$.

Finally, the process ends with the transmission of knowledge and attitudes to children's adoption of concrete practices ($P_c$) to ameliorate the negative effects of marine plastic pollution. Following equations (1) and (2), indirect effects on children's practices coming from parents' knowledge ($K_p$) and attitudes ($A_p$) are also included to model the process

[2] For more information, see: Mansaray et al. (1998), Mlipha and Manyatsi (2005), Hai et al. (2010), Kioko and Kiringe (2010), Cardwell (2011), Wan-Nuríashiqin et al. (2011), Awang et al. (2013), Johar and Razak (2015), Da Silva (2015) and Fernández-Manzanal et al. (2015).

underlying practices. This relation is depicted in equation (3):

$$P_c = h\left(K_c\ \left(K_p\right), A_c\left(A_p\right), P_p, Z\ \right) \quad (3)$$

Practices related to the consumption and disposal of plastic can be affected by four potential factors. The first two follow the transmission mechanism in which practices can be influenced directly by children's knowledge ($K_c$) and attitudes ($A_c$) acquired individually, and indirectly by parents' knowledge ($K_p$) and attitudes ($A_p$). We expect that knowledge and attitude has a positive influence on practices within the child's value system ($P_{K_c} > 0$ , and $P_{A_c} > 0$). Moreover, parents' practices ($P_p$) can also affect children's behavior regarding the use and disposal of plastic. Our expectation is that parents will exert a positive influence on their children in this domain ($P_{P_p} > 0$). Finally, children's practices may also be affected by past experiences with environmental issues, in which case $P_z > 0$. Because the proposed process of transmission of behavior from parents to children as well as the hierarchical nature of the KAP are both empirical questions, our empirical strategy proposes a mechanism that allow us to evaluate these questions. This mechanism is comprehensively discussed in section 4.

## 3. Material and methods

### 3.1. Data

We use data from a sample of schools participating in the sustainable school program in southern Chile. The sustainable school program seeks to be a comprehensive strategy to approach environmental education for sustainability in educational establishments throughout the country, from early childhood education to secondary education. It is a voluntary system that gives a public certificate to educational establishments that successfully implement strategies for environmental education in their communities. Strategies encompass three scopes of action: curricular, management, and relationship with the surroundings. From a total of 205 schools participating in this program in 2018, we randomly select a matched sample of 30 schools based on the following observable characteristics: (i) coastal versus non-coastal towns, (ii) low-versus high-income schools, (iii) public versus private schools, and (iv) low- and high-level of environmental commitment of schools, based on the school's performance in the sustainable school program. School's principals received a letter by which they were informed on the study and asked for their consent. The sample allows us to consider the extensive heterogeneity among schools in Chile, which is regarded as one of the contextual factors in our behavioral model. We adapted the KAP model to develop a survey about plastic pollution, which was administered to 1,521 children in fourth-grade elementary school and to their parents. In the Chilean educational system, the age of fourth-grade students is around 9–10 years old. The questions were carefully designed with the advice of an educational team and were administered in-person. Because we visited all fourth-grade courses on each school, this process consisted of two stages. In the first stage, our fieldwork team visited each school to administer the survey to children. To this end, schools granted us two pedagogic hours that are usually assigned to the subject of natural science. This allowed us to simultaneously apply the survey to all children belonging to a class, while supervising the process of responses, which in turn allow us to guarantee that answers were individual. Clarification of doubts were provided on individual basis (in private), when needed. Upon completion of the survey, the fieldwork team collected the surveys for processing out of schools. The second stage consisted on gathering information from parents. Upon completion of the children's survey, our enumerators provided the teacher in charge of the class with the parent's questionnaire, which was delivered to them, in person, when picking up the children at the end of the school day. The delivery method was the communication book where schools include the homework and important information to parents. According to the instructions, parents were given one week to return the questionnaire to the school, while being asked not to discuss with their children about the survey and its contents. To ensure that the children could understand all the questions, we conducted a pilot test with students of similar ages to the target sample. Moreover, to guarantee the confidentiality of both children and parents, the survey was completely anonymous. To match the children's survey with the parent's survey, we created a unique ID by household.

The survey has three sections with questions aimed at gathering information on knowledge, attitudes, and practices related to marine plastic pollution. The parent survey includes an additional section with questions about household characteristics. The knowledge section was an adaptation of questions included in the educators' guide to marine debris, designed by the North American Marine Environment Protection Association in partnership with the National Oceanic and Atmospheric Administration (NOAA). This guide is based on NOAA's Turning the tide on trash: A learning guide on marine debris (NOAA, 2015).

To measure knowledge, attitudes, and practices, we constructed a series of indexes ranging from 0 to 1. The index of knowledge consists of the percentage of correct answers from a list of 11 questions. To compute indexes of attitudes and practices, we follow the procedure outlined in Boudet et al. (2016). Concerning the attitude index, we used a series of questions as follows: "*Based on your experience, on a 1–5 scale, please indicate to which extent the following problems are relevant environmental problems in your neighborhood/commune of residence*". These problems include: climate change; air, water and noise pollution; inland and ocean trash; lack of green areas; droughts due to insufficient/lack of rain; and abandoned animals. The relevant answers here were ocean and/or inland trash. Because communes are the places where children and parents spend most of their time, we believe this is a good proxy of individuals' awareness and concern regarding the most relevant environmental problems they are currently experiencing, or have experienced in the past. Moreover, because children and parents in our sample come from different communes in the region, we expect this heterogeneity could inform us on the relative importance -and perceptions-of ocean and inland trash as a problem affecting their lives.[3] The another questions reads: "*On a 1–4 scale, how important is it for you not to use plastic bags and straws?*" To build the attitude index, first, we transform the two first answers (ocean and inland trash) with a scale of 1–5 by normalizing it to range from zero to one as follows: if the response of the parent or student was 1, we assigned the value 0, if it was 2, we assigned the value 0.25, to 3 the value of 0.5, to 4 the value of 0.75 and to 5 the value of 1. For the question with a scale of 1–4, we assigned the value 0 if the response was 1, 0.33 if the response was 2, 0.67 if the response was 3, and 1 if the response was 4. Second, we averaged the normalized questions to obtain the index.

Finally, we build three indexes for practices. To construct these indexes, we follow the same procedure as before. The first index explores the plastic composition of the children's lunch box, measured by the percentage of food items that are packed with reusable materials. A higher value indicates that children and parents use less single-use plastic when it comes to packing food for school. To generate this index, we ask children and parents detailed information regarding the type (i.e., food items consumed on a regular basis) and packaging (i.e., single-use plastic versus reusable utensils) of each of the elements included in the children's lunch box. Because children in our sample are,

[3] Unlike other countries, the Chilean territorial division exhibits important features. While neighbourhoods are rather small units with basic infrastructure that could vary to some extent in response to socio-economic characteristics, most amenities and environmental public goods are provided at the commune level. The fact that children from different neighborhoods visit different communities within a same region provides a good setting not only to form their perceptions regarding the existence and severity of environmental problems in their surroundings, but also the need of undertaking actions to tackle these problems, being the latter an important source of attitude formation.

on average, 9–10 years old, as such age, they have developed their own preferences regarding what to eat, and the type and design of the packing utensils. Cultural features of the Chilean society provide reasons to believe the packing of the children's lunch box is the result of a two-stage decision-making process. In the first stage, children reveal their preferences regarding the content of the lunch box, which generally take place either at home or directly at the supermarket.[4] The content of the purchase indirectly defines the packing characteristics. The second stage takes place in the household, when preparing the meal to be included in the lunch box. Depending on a number of characteristics, the process of packaging can be performed by the children, one of their parents, or jointly. Thus, we believe that the ultimate content and packaging method of the children's lunch box is mostly a children's decision -or the result of a join decision-making process where children's participate actively-, despite this practice not necessarily being performed by children on a daily basis. The next two indexes measure practices in avoiding plastic consumption and effort for recycling. These indexes were constructed using questions about the frequency with which people report avoiding plastic consumption and participating in recycling programs. Although these indexes are somewhat general from a consumption perspective, they included some practices that could be performed by children under the supervision of their parents (e.g., avoid purchasing juice packed in plastic bottles, segregate plastic waste at home, bring recycling items to recycling facilities, etc.).[5] Descriptive statistics of the indexes for both children and parents are presented in Table 1.

As expected, parents are significantly more knowledgeable about marine plastic pollution than their children, show a greater concern for the problem, and report partaking in actions to avoid plastic consumption with more frequency. The largest difference is in knowledge, where parents performed around 10% better than children in the quiz about marine plastic pollution. There is also a noticeable difference of around 6% as it comes to avoid plastic consumption in favor of parents. Differences in attitudes are small, and does not surpass 4%.

On the contrary, children are more likely than their parents to report recycling and using disposable items to pack the lunch box. Whereas the gap in this last practice is smaller and does not surpass 3%, recycling actions are 11% more frequently mentioned by children relative to parents.

In addition to parents' influence in the transmission of knowledge to practices among children, and based on our model of behavior outlined in section 2.2, our survey instrument also allows us to gather information on a set of explanatory variables to control for household's characteristics and other contextual factors. Regarding household characteristics, we consider the following variables: a dummy variable that takes the value 1 if the guardian is one of the parents and zero otherwise (Dummy Parents – guardian); the age of parents; household size measured by the number of members in the household; involvement in children's education, which is an index that comprises different questions to proxy for the level parents interact with children when it comes to school activities[6]; years of formal education of both mother and father; and the logarithm of the households' income. We also include variables that indicate the children's previous experience with marine plastic pollution. These are dichotomous variables that take the value of one if the child answered positively to the following questions (and zero otherwise). Exp*1:* Have you ever seen garbage in the ocean/beach? Exp*2:* Is there trash/plastic waste in your surroundings (i.e., inland or marine)? Exp*3:* Have you ever seen a relative/friend/neighbor littering? and Exp*4:* Do you know of a neighbor or friend who recycles or does something to protect the environment? Altruism is a variable capturing the willingness to contribute to something with no return. This was obtained from the following question: On 1–10 scale, how willing are you to contribute in good causes without receiving something in return? Finally, we include children's gender as a dummy variable, taking the value of one for male and zero for female.

In terms of school characteristics, we incorporate dummy variables to control for school dependence (public, private-voucher, and private-paid schools). To explore if a school's educational performance has any impact on KAP transmission, we included the logarithm of the average fourth-grade score in the Sistema de Medición de la Calidad de la Educación (SIMCE, by its Spanish acronym) test. This is a standardized test applied throughout the Chilean education system. Schools in our sample show a previous level of environmental commitment as they participate in the sustainable school program. This commitment is measured by the level of environmental certification they have received, using dummy variables. Finally, we add a dummy variable that takes the value one when the school $i$ is in a coastal commune and zero otherwise. Descriptive statistics of the main explanatory variables are available in Table 2.

In our sample, most of guardians are children's parents (95.78%) with an average age of 38.8 years old. On average, parents' schooling is slightly higher than years required to complete secondary education (high school). The average size of households is around 3.5 members. Regarding schools' characteristics, 48.39% of children attend public schools, 37.44% attend private-voucher schools, and 12.9% attend private-paid schools. In addition, 19.48% of children study in schools that report having the basic environmental certification, 14.56% of them are enrolled in schools with a medium environmental certification, and 65.97% of children in our sample are in schools reaching the highest level of environmental certification. Finally, 37.7% of children study in schools located in coastal communes.

**Table 1**
Descriptive statistics of KAP indexes (children and parents).

| Variable | *Children* | | *Parents* | | Difference | *p*-value |
|---|---|---|---|---|---|---|
| | Obs. | Mean | Obs. | Mean | | |
| Knowledge | 1521 | 0.5379 (0.2047) | 1521 | 0.6427 (0.2677) | −0.1048 | 0.0000 |
| Attitudes | 1370 | 0.7999 (0.1978) | 1270 | 0.8390 (0.1878) | −0.0391 | 0.0000 |
| Practices - Lunch Box | 1362 | 0.4530 (0.3430) | 1278 | 0.4253 (0.3564) | 0.0277 | 0.0415 |
| Practices - Consumption | 1354 | 0.5604 (0.2141) | 1260 | 0.6274 (0.2130) | −0.0670 | 0.0000 |
| Practices - Recycling | 1385 | 0.4674 (0.2813) | 1285 | 0.3505 (0.2903) | 0.1169 | 0.0000 |

*Note*: Diff = mean(children) - mean(parents).
*Source*: own elaboration. Standard deviation in parenthesis.

### 3.2. Estimation framework

Based on our conceptual framework and empirical literature, we propose estimating a recursive model that can analyze the links between knowledge, attitudes, and practices of children, while taking into ac-

[4] Grocery shopping in Chile is an activity that takes place mostly on weekends, where the entire family participates.

[5] The questionnaires designed for the purposes of this study are available upon request.

[6] The questions are the following: Do you attend parents/guardian meetings at your child's school? Are you familiar with the dates of your children's tests/exams? Do you help your children study at home? Are you familiar with your children's homework? Do you help your children do his/her homework? and; Do you participate in your children's school activities to which parents/guardians are invited? The parents responded to each of these questions from 1 to 5, where 1 indicates never, 2 hardly ever, 3 sometimes, 4 very often, and 5 always.

**Table 2**
Descriptive Statistics of main explanatory variables.

| Variable | Obs. | Mean | Std. Dev. | Min | Max |
|---|---|---|---|---|---|
| *Households' characteristics* | | | | | |
| Dummy Parents - guardian | 1326 | 0.9578 | 0.2012 | 0 | 1 |
| Age of guardian | 1232 | 38.4 | 7.7 | 23 | 83 |
| Household size [No.] | 1325 | 3.5 | 1.4 | 1 | 9 |
| Involvement in children's educ. | 1295 | 0.873 | 0.1243 | 0 | 1 |
| Mother's formal education [years] | 1297 | 12.8 | 3.2 | 0 | 23 |
| Father's formal education [years | 1212 | 12.7 | 3.6 | 0 | 23 |
| ln (Households' income) | 1277 | 13.1 | 0.7689 | 11.9 | 14.6 |
| *Children's Characteristics* | | | | | |
| Gender | 1521 | 0.4892 | 0.5000 | 0 | 1 |
| Children's Experience 1 | 1388 | 0.9193 | 0.2725 | 0 | 1 |
| Children's Experience 2 | 1390 | 0.7396 | 0.4390 | 0 | 1 |
| Children's Experience 3 | 1383 | 0.7115 | 0.4532 | 0 | 1 |
| Children's Experience 4 | 1388 | 0.4697 | 0.4993 | 0 | 1 |
| Children's Altruism Level | 1388 | 8.2 | 2.3 | 1 | 10 |
| *Schools' Characteristics* | | | | | |
| Dummy Public School | 1521 | 0.4852 | 0.4999 | 0 | 1 |
| Dummy Private-voucher School | 1521 | 0.3754 | 0.4844 | 0 | 1 |
| Dummy Private-paid School | 1521 | 0.1394 | 0.3465 | 0 | 1 |
| ln (SIMCE) | 1521 | 6.3 | 0.0791 | 6.1 | 6.4 |
| Basic environmental certification | 1521 | 0.1953 | 0.3965 | 0 | 1 |
| Medium environmental certification | 1521 | 0.1453 | 0.3525 | 0 | 1 |
| Excellence environmental certification | 1521 | 0.6594 | 0.4741 | 0 | 1 |
| Coastal Commune | 1521 | 0.3761 | 0.4846 | 0 | 1 |

*Source*: own elaboration based on the survey data.

count the potential effects of parents' KAP on children. The behavior of child $i$ can be represented by the following system of equations:

$$K_{c_i} = \alpha_0 + \alpha_1 K_{p_i} + \alpha_2 X_i + \varepsilon_i \quad (4)$$

$$A_{c_i} = \beta_0 + \beta_1 K_{ci} + \beta_2 A_{p_i} + \beta_3 S_i + \varepsilon_i \quad (5)$$

$$P_{ci} = \delta_0 + \delta_1 K_{ci} + \delta_2 A_{ci} + \delta_3 P_{p_i} + \delta_3 Z_i + \varepsilon_i \quad (6)$$

Where the vectors $\alpha_j$ $(j = 1, \ldots, 3)$, $\beta_j$ $(j = 1, \ldots, 4)$ and $\delta_j$ $(j = 1, \ldots 5)$ correspond to the estimated coefficients of the knowledge $(K_c)$, attitudes $(A_c)$ and practices $(P_c)$ equations, respectively. Because we hypothesize that children's behavior can be affected by their parents' KAP, these dimensions are denoted by the variables $K_p$, $A_p$ and $K_p$. Other contextual variables are embedded in the vectors $X_i, S_h$ and $Z_s$, which include a set of characteristics at the children-, household- and school-levels; finally, $\varepsilon_i$ represents the error term. Assuming that the different dimensions of children's KAP are linked, we expect the coefficients $\beta_1$, $\delta_1$ and $\delta_2$ to be positive and statistically significant. Moreover, assuming parents exert a positive influence on children through their own KAP, we expect the estimated coefficients $\alpha_1$, $\beta_2$ and $\delta_3$ to be positive and statistically significant.

The recursiveness of the specification is analyzed by testing the exogeneity of children's knowledge to explain children's attitudes, and the exogeneity of children's attitudes to explain children's practices. Traditionally, an instrumental variable approach is used to identify the effect of one variable on a phenomenon of interest as the first is suspected to be endogenous. According to our specification based on the KAP model, children's knowledge may be endogenous to attitudes, while attitudes may be endogenous to practices. To evaluate whether this is true, we need to come up with an instrument that affects strongly the suspicious endogenous variable, but does not have a significant impact on outcomes. To do so, we use parents' knowledge, attitudes, and practices as instruments for estimating a Two-Stage Least Square model. We also test the exclusion restriction assumption and the strength of the instruments. The use of parents' characteristics to explain children outcomes has been extensively used in previous literature (see, for example, Lindeboom, et al., 2009; Chevalier et al., 2013; Carneiro et al., 2013; Dickson et al., 2016; Fruehwirth & Gagete-Miranda, 2019). Altogether, equations (4)–(6) allow us to empirically evaluate the process of behavioral transmission from parents to children, which is our main research question. The evaluation of the hierarchical nature of children's KAP dimensions, i.e., whether high order dimensions could influence lower order dimensions in an individual's value system, is also tested.

## 4. Results

We begin by testing the recursiveness of our model through the instrumentation of children attitudes and practices with the corresponding variables for parents. To this end, considering attitude as a dependent variable, we use parents' knowledge as an instrument to explain children's knowledge. When modeling practices, we employ parents' attitudes to explain children's attitudes. We first test if instruments are strong and valid. Then, we evaluate the exogeneity of children's knowledge and attitudes. Table 3 shows the $p$-values of the IV tests. The results of the Two-Stage Least Square model are presented in Table A1 in the Appendix.

This table evidences that our instruments pass the test of overidentification, while also being strong. This means that there is statistically evidence to support the exclusion of parents' knowledge from children's attitude equation and parents' attitude from practices' children equation. In other words, whereas parents' knowledge affects children's attitudes indirectly by influencing children's knowledge, parents' attitude affects indirectly children's practices by shaping children' attitudes. Thus, we can also say that parents' knowledge influence parents' practices indirectly. We also reject the hypothesis of children's knowledge being endogenous in explaining their own attitudes, and children's attitudes being endogenous in the equations modeling children's practices. These results provide evidence of a recursive structure of the KAP model. Next, the Ordinary Least Square (OLS) model is applied to estimate equations [4], [5], and [6]. Estimated coefficients after OLS are shown in Table 4.

Column 1 in Table 4 shows estimates of children's knowledge, while column 2 presents estimates of children's attitudes. Columns 3 to 5 explore the determinants of children's practices with respect to the consumption and disposal of plastic. Results reveal a significant effect of parent's knowledge on children's knowledge, suggesting that children who have parents with more knowledge on plastic pollution will have greater environmental knowledge on the same topic. We find very few significant variables affecting children's knowledge, which is reasonable given the specific topic. Only household size and whether children attend a private-voucher school are statistically significant to explain knowledge. They suggest that knowledge tends to be lower in more numerous families and higher in private-voucher schools.

Regarding attitudes, we find that both children's knowledge and parents' attitudes are statistically significant for making children more aware of the marine plastic pollution problem. This result contrasts with previous evidence showing no significant effect of environmental knowledge on attitudes within the student's value system (Levine and Strube; 2012). It is worth mentioning that previous evidence relies on measuring basic and general knowledge on environment, while our paper measures accurate knowledge on a particular environmental issue. Thus, differences in results may be driven by how specific knowledge is. In addition, our results show that not only specific environmental knowledge can be transmitted from parents to children but also concerns and awareness on environmental issues can be, too. We also find children who identify as female, are more altruistic, are aware of environmental problems in their surroundings, are enrolled in public schools with higher educational performance, and are enroll in schools with a higher level of environmental certification show more concerns about marine plastic pollution.

In terms of children's practices regarding plastic consumption and

**Table 3**
Testing exogeneity.

| Dependent Variable | Model | Tests of endogeneity (p-value) | Test for weak instruments (p-value) | Test of overidentification (p-value) |
|---|---|---|---|---|
| Attitude | IV 2sls | 0.6017 | 0.0279 | 0.0000 |
| Practices - Lunch Box | IV 2sls | 0.8209 | 0.0186 | 0.0000 |
| Practices - Consumption | IV 2sls | 0.5459 | 0.0159 | 0.0000 |
| Practices - Recycling | IV 2sls | 0.9522 | 0.0219 | 0.0000 |

Note: H0: The variable is exogenous H0: Instruments are weak H0: variable excluded in an equation is valid.
*Source*: own calculations based on survey data.

recycling, we find dissimilar results depending on the kind of practice. For the lunch box index, neither children's knowledge nor attitudes matter in explaining the use of reusable materials in lunch boxes. In contrast, results evidence that these dimensions of the KAP are relevant for avoiding plastic consumption and undertaking recycling practices, being their effects on these indexes statistically significant, as shown in columns (4) and (5). Other factors related to children's past experiences, altruism, and school environmental certification are also important for encouraging a change in the use of plastics. Surprisingly, children who are more knowledgeable about marine plastic pollution seem less willing to make voluntary efforts to recycle. This result can be attributed to recycling being perceived as the option with less impact on reducing plastic marine pollution (because plastic is returned back to the system), as opposed with avoiding using plastics altogether. A significant and sizeable reduction in plastic consumption among children with a higher level of knowledge on this issue is consistent with reducing plastic consumption being the preferred option as knowledge increases.

Moreover, results reveal that transmission from parents to children also occurs in the practice domain of KAP, particularly when deciding on what kinds of containers to use in lunch boxes and when deciding whether to recycle. This result is reasonable since parents are the ones that prepare food for children, and the decision to recycle is made at home, where it is more visible for children. On the contrary, decisions about plastic consumption are taken outside, where parent-children interactions become more limited. This in line with what found by Grønhøj and Thøgersen (2009, 2012) and Matthies et al. (2012) in recycling behavior. The authors argue that pro-environmental behaviors of parents that are more visible lead to a higher participation in these behaviors on the part of the children. For example, the separation of waste, which occurs more frequently and regularly in the home, is more visible to all family members, unlike other less-visible behaviors such as reuse behavior and the use and consumption of electricity.

The presence of a hierarchical nature in the behavior of children and parents is an empirical question. To explore this further, in an additional exercise, we include parents' practices in equations (1) and (2) as an exogenous variable explaining children's knowledge and attitudes, respectively. We test this association in our empirical analysis. Results indicate that parent's practices do not affect fundamentally children's knowledge and attitudes (one practice in either cases are only significant at 10%), supporting the notion of a hierarchical model of behavior. These results are available upon request.

To conclude, as a robustness check, we estimate a Log-odds ratio model for each consumption and disposal indexes. This model accounts for the fact that our dependent variable is bounded between zero and one. Overall, results remain robust with respect to those in the alternative specification. Estimated coefficients are presented in Table A2 (Appendix).

## 5. Discussion

Environmental education is seen as a key instrument to promote pro-environmental behavior at an early stage since people become more reluctant to change behavior with the years. Children can learn about the importance of taking care the environment at schools, but this learning process is undoubtedly influenced by their parents. In addition, this process seems to be sequential as knowledge is supposed to boost attitudes, and, in turn, attitudes may play a key role in promoting practices that reduce negative impacts on the environment.

Our results evidence the significant influence parents exert on children's pro-environmental behaviors, which is consistent with Bandura's (1986) social learning theory. This influence was also documented when studying children and parents with similar age range (Ando et al., 2005), and among adolescents (Grønhøj & Thøgersen,2009, 2012). Findings are also in line with the notion that this influence is an important driver of behavior, regardless of culture (Ando et al., 2005). This paper adds important insights to this literature, by focusing in a middle-income country like Chile, where promoting pro-environmental preferences and behaviors within the family may compete with transmission of values in other areas. Despite the strong evidence supporting a positive influence of parents on the behavior of children, our findings contrast with that of Evans et al. (2007), which finds no evidence of transmission of behavior within the family. Although this study also focused on school children, its targeted population consisted of first and second grade students, which are younger than the fourth-grade children participating in our study. It can be expected that at such young age, children's value system is not fully developed to internalize the causes and consequences of environmental problems, preventing the subsequent need of undertaking specific actions to tackle this problem.

Altogether, our findings support the notion of the family as a context for pro-environmental socialization. In such context, children's learning and transmission of behavior could emerge as a result of observation, social interaction and positive reinforcement among family members (Moschis, 1987). Because of their influence on children, parents are important role models for the transmission of pro-environmental behavior in early stages of life. The latter highlights the importance of promoting parent's participation in environmental education activities promoted by schools to maximize the short- and long-term effect of such initiatives.

## 6. Conclusions

In this paper, we analyze the transmission process of knowledge, attitudes, and practices regarding plastic marine pollution among school children in southern Chile. We explore the role that parents play in this transmission by testing the effect of the parents' knowledge, attitudes, and practices on the same outcomes of their children within a hierarchical model. In our estimations, we use parents' outcomes as instruments to test the existence of recursiveness in the structure of this transmission within the children's value system. This strategy is supported by an extensive literature testing parents' education to explain children's outcomes (see, e.g., Lindeboom et al., 2009; Chevalier et al., 2013; Carneiro et al., 2013; Dickson et al., 2016; Fruehwirth & Gagete-Miranda, 2019).

Results evidence that the transmission from knowledge to practices occurs as a recursive and hierarchical process in which knowledge affects attitudes and knowledge and attitudes influence practices. We also find evidence that parents' behavior significantly explains children' behavior, and transmission happens not only through knowledge and attitudes but also in the domain of practices. Among different types of practices considered in this study, transmission from parents seem to be

**Table 4**
Estimated coefficients of the OLS Model (Children).

| | Knowledge (1) | Attitudes (2) | Practices - Lunch Box (3) | Practices – Consumption (4) | Practices – Recycling (5) |
|---|---|---|---|---|---|
| *KAP* | | | | | |
| Knowledge Parents | 0.1327** | | | | |
| | (0.0554) | | | | |
| Knowledge Children | | 0.1096** | 0.1226 | 0.1820*** | −0.1100* |
| | | (0.0457) | (0.0862) | (0.0531) | (0.0640) |
| Attitudes Parents | | 0.0784** | | | |
| | | (0.0345) | | | |
| Attitudes Children | | | 0.0822 | 0.0890** | 0.0803* |
| | | | (0.0589) | (0.0390) | (0.0468) |
| Practices - Lunch Box Parents | | | 0.0765** | | |
| | | | (0.0328) | | |
| Practices - Consumption Parents | | | | 0.0403 | |
| | | | | (0.0325) | |
| Practices - Recycling Parents | | | | | 0.0728** |
| | | | | | (0.0303) |
| *Household's Characteristics* | | | | | |
| Dummy Parents - guardian | 0.0276 | −0.0155 | 0.0210 | −0.0405 | −0.0380 |
| | (0.0316) | (0.0419) | (0.0690) | (0.0430) | (0.0555) |
| Age of guardian | −0.0062 | −0.0048 | 0.0180 | −0.0031 | −0.0013 |
| | (0.0057) | (0.0079) | (0.0125) | (0.0082) | (0.0100) |
| Sqrt (Age of guardian) | 0.0001 | 0.0001 | −0.0002 | 0.0001 | 0.0000 |
| | (0.0001) | (0.0001) | (0.0002) | (0.0001) | (0.0001) |
| Household size [No.] | −0.0088* | −0.0010 | 0.0064 | −0.0132** | 0.0117* |
| | (0.0048) | (0.0051) | (0.0090) | (0.0061) | (0.0069) |
| Involvement in children's education [index] | −0.0080 | 0.0712 | −0.0626 | −0.0590 | 0.0309 |
| | (0.0438) | (0.0510) | (0.0883) | (0.0523) | (0.0718) |
| Mother's formal education [years] | 0.0022 | −0.0005 | −0.0037 | 0.0016 | 0.0028 |
| | (0.0024) | (0.0029) | (0.0051) | (0.0035) | (0.0041) |
| Father's formal education [years] | 0.0011 | 0.0027 | 0.0003 | 0.0013 | 0.0013 |
| | (0.0024) | (0.0025) | (0.0048) | (0.0027) | (0.0035) |
| ln (Household's income) | 0.0024 | 0.0076 | 0.0041 | 0.0281* | −0.0044 |
| | (0.0127) | (0.0141) | (0.0241) | (0.0153) | (0.0176) |
| *Children's Characteristics* | | | | | |
| Gender (male) | −0.0105 | −0.0296** | 0.0118 | −0.0064 | 0.0079 |
| | (0.0102) | (0.0128) | (0.0225) | (0.0138) | (0.0174) |
| Children's Experience 1 | | 0.0714*** | −0.0287 | 0.0554** | 0.0813** |
| | | (0.0273) | (0.0401) | (0.0279) | (0.0317) |
| Children's Experience 2 | | 0.0206 | −0.0295 | 0.0078 | −0.0493** |
| | | (0.0155) | (0.0254) | (0.0159) | (0.0200) |
| Children's Experience 3 | | 0.0342** | 0.0440* | 0.0023 | 0.0089 |
| | | (0.0157) | (0.0247) | (0.0159) | (0.0200) |
| Children's Experience 4 | | 0.0169 | 0.0471** | 0.0172 | 0.1491*** |
| | | (0.0127) | (0.0222) | (0.0139) | (0.0176) |
| Children's Altruism Level | | 0.0097*** | 0.0172*** | 0.0203*** | 0.0292*** |
| | | (0.0029) | (0.0047) | (0.0035) | (0.0038) |
| *School's Characteristics* | | | | | |
| Dummy Private-voucher School | 0.0504*** | −0.0111 | −0.0490 | 0.0290 | 0.0369* |
| | (0.0129) | (0.0167) | (0.0298) | (0.0182) | (0.0222) |
| Dummy Private-paid School | 0.0115 | −0.1234*** | 0.0900 | 0.0635* | 0.0746* |
| | (0.0244) | (0.0318) | (0.0548) | (0.0330) | (0.0433) |
| ln (SIMCE) | 0.0990 | 0.0809 | −0.6665*** | −0.0255 | −0.0383 |
| | (0.0999) | (0.1246) | (0.2438) | (0.1382) | (0.1867) |
| Basic environmental certification | −0.0134 | −0.0461*** | −0.1086*** | −0.0080 | −0.0298 |
| | (0.0168) | (0.0177) | (0.0316) | (0.0201) | (0.0254) |
| Medium environmental certification | −0.0079 | −0.0593** | −0.1505*** | −0.0298 | −0.0249 |
| | (0.0211) | (0.0259) | (0.0445) | (0.0275) | (0.0326) |
| Coastal Commune | 0.0078 | 0.0137 | 0.0913*** | 0.0245 | −0.0055 |
| | (0.0113) | (0.0133) | (0.0238) | (0.0153) | (0.0189) |
| Constant | −0.1395 | −0.0749 | 4.0189*** | 0.0319 | 0.2847 |
| | (0.6314) | (0.7638) | (1.5343) | (0.8734) | (1.1415) |
| N | 1,065 | 927 | 908 | 890 | 920 |
| R2 | 0.0628 | 0.1117 | 0.0889 | 0.1746 | 0.2015 |
| Adjusted R2 | 0.0485 | 0.0901 | 0.0651 | 0.1527 | 0.1810 |
| Prob > F | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |

*Note*: *p < 0.1; **p < 0.05; ***p < 0.0. Robust standard errors in parenthesis.

stronger among practices that are closer linked with children (e.g. lunch box) and those that are more visible to children (e.g. recycling versus consumption).

This paper has several policy implications for the design of environmental educational programs. First, school programs focusing on providing more knowledge on environmental issues to children can trigger a transmission process where this knowledge will translate into pro-environmental practices. To accompany this transmission process, a significant effect of knowledge, attitudes and practices of parents on children's outcomes remind us that understanding parents' influence on children's pro-environmental behavior is quite relevant for better designing environmental education programs. Second, the fact that socialization within the family provides an interesting context for learning, a larger influence of parents on children found in more visible

pro-environmental practices, such as lunch box packing and recycling, shed some light on the importance of promoting parent-child homework activities to strengthen the intergeneration transmission of environmental personal norms and environmental awareness within the household value system.

One interesting venue for future research connects with a growing literature arguing a reverse causality in the intergenerational transmission of environmental values, suggesting that knowledge learned by children could challenge the values and beliefs of their parents (Duvall & Zint, 2007). In particular, this literature suggests that transfer of environmental knowledge, attitudes and behavior to adults may be promoted by providing environmental knowledge directed at children (e.g. Boudet et al., 2016; Ekström, 2007; Grønhøj, 2006; Larsson et al., 2010; Lawson et al., 2018; Maddox et al., 2011; Williams et al., 2017). Our data was collected from surveys administrated to both children and parents without providing any formal knowledge about the topic. Thereby, we believe that it is reasonable to think that causation can come from parents to children, and therefore we used parents' KAP as exogenous variables to estimate our model. To test a potential reverse causality in children/parents association of KAP, it would be necessary to have experimental data by implementing a comprehensive environmental education campaign in a sample group of schools and measuring KAP before and after the intervention in both the treated and control schools. However, this is out of the scope of this paper and constitute future research. Along these lines, another potential extension consists of analyzing the role schools play in shaping children's KAP in response to the implementation of environmental education programs aimed at incentivizing pro-environmental behavior among children. An analysis of this sort could help understanding the potential differentiated effects of educational programs for children attending to schools with specific characteristics. This is particularly important in developing and middle-income countries like Chile, where social and income inequality is also featured in the school system, and where promoting pro-environmental behavior in early stages of life is of uttermost importance to incentivize long-term changes in behavior.

## Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

## Acknowledgement

Authors gratefully acknowledge financial support from SIDA through the Sustainable Management of Coastal Marine Resources (EfD-CMaR). César Salazar acknowledges financial support from project FONDAP, No. 15110027. Marcela Jaime acknowledges funding from CAPES through ANID PIA/BASAL FB0002.

## Appendix A. Additional tables and figures

**Table A1**
Econometrics Results of Two-Stage Least Square Model (Children)

| | (1) | (2) | (3) | (4) |
|---|---|---|---|---|
| | Attitudes | Practices - Lunch Box | Practices - Consumption | Practices - Recycling |
| *KAP* | | | | |
| Knowledge Children | −0.2412 | 0.1310 | 0.2128*** | −0.1136 |
| | (0.6807) | (0.1188) | (0.0677) | (0.0822) |
| Attitudes Parents | 0.0692* | | | |
| | (0.0397) | | | |
| Attitudes Children | | −0.0727 | −0.1964 | 0.1107 |
| | | (0.6872) | (0.4712) | (0.5455) |
| Practices - Lunch Box Parents | | 0.0826** | | |
| | | (0.0379) | | |
| Practices - Consumption Parents | | | 0.0349 | |
| | | | (0.0339) | |
| Practices - Recycling Parents | | | | 0.0663** |
| | | | | (0.0303) |
| *Household's Characteristics* | | | | |
| Dummy Parents - guardian | −0.0078 | 0.0361 | −0.0281 | −0.0009 |
| | (0.0484) | (0.0694) | (0.0440) | (0.0585) |
| Age of guardian | −0.0066 | 0.0131 | −0.0069 | −0.0056 |
| | (0.0090) | (0.0128) | (0.0099) | (0.0103) |
| Sqrt(Age of guardian) | 0.0001 | −0.0002 | 0.0001 | 0.0001 |
| | (0.0001) | (0.0002) | (0.0001) | (0.0001) |
| Household size [No.] | −0.0020 | 0.0052 | −0.0138** | 0.0120* |
| | (0.0057) | (0.0090) | (0.0060) | (0.0069) |
| Involvement in children's education [index] | 0.0649 | −0.0568 | −0.0289 | 0.0289 |
| | (0.0517) | (0.1029) | (0.0694) | (0.0834) |
| Mother's formal education [years] | −0.0002 | −0.0032 | 0.0017 | 0.0018 |
| | (0.0030) | (0.0051) | (0.0037) | (0.0041) |
| Father's formal education [years] | 0.0035 | 0.0000 | 0.0011 | 0.0001 |
| | (0.0030) | (0.0051) | (0.0029) | (0.0038) |
| ln(Household's income) | 0.0098 | −0.0004 | 0.0273 | −0.0009 |
| | (0.0148) | (0.0246) | (0.0167) | (0.0176) |
| *Children's Characteristics* | | | | |
| Gender | −0.0300** | 0.0054 | −0.0097 | 0.0090 |
| | (0.0131) | (0.0272) | (0.0173) | (0.0231) |
| Children's Experience 1 | 0.0858** | −0.0159 | 0.0704* | 0.0758 |
| | (0.0388) | (0.0651) | (0.0412) | (0.0508) |
| Children's Experience 2 | 0.0288 | −0.0261 | 0.0197 | −0.0483** |
| | (0.0219) | (0.0295) | (0.0215) | (0.0233) |
| Children's Experience 3 | 0.0427* | 0.0512 | 0.0165 | 0.0103 |

(*continued on next page*)

**Table A1** (*continued*)

| | (1) | (2) | (3) | (4) |
|---|---|---|---|---|
| | Attitudes | Practices - Lunch Box | Practices - Consumption | Practices - Recycling |
| | (0.0237) | (0.0365) | (0.0231) | (0.0279) |
| Children's Experience 4 | 0.0103 | 0.0445* | 0.0192 | 0.1449*** |
| | (0.0178) | (0.0257) | (0.0165) | (0.0197) |
| Student's Altruism Level | 0.0102*** | 0.0175** | 0.0230*** | 0.0285*** |
| | (0.0031) | (0.0084) | (0.0058) | (0.0068) |
| *School's Characteristics* | | | | |
| Dummy Private-voucher School | −0.0024 | −0.0465 | 0.0243 | 0.0380* |
| | (0.0244) | (0.0349) | (0.0189) | (0.0226) |
| Dummy Private-paid School | −0.1265*** | 0.0949 | 0.0287 | 0.0803 |
| | (0.0326) | (0.1092) | (0.0703) | (0.0848) |
| ln(SIMCE) | 0.1646 | −0.6967*** | 0.0275 | 0.0152 |
| | (0.2051) | (0.2556) | (0.1463) | (0.1970) |
| Basic environmental certification | −0.0428** | −0.0961** | −0.0210 | −0.0190 |
| | (0.0191) | (0.0457) | (0.0298) | (0.0355) |
| Medium environmental certification | −0.0487 | −0.1630*** | −0.0514 | −0.0218 |
| | (0.0346) | (0.0603) | (0.0366) | (0.0459) |
| Coastal Commune | 0.0153 | 0.0904*** | 0.0269 | −0.0076 |
| | (0.0140) | (0.0260) | (0.0171) | (0.0208) |
| Constant | −0.4297 | 4.4352*** | −0.0874 | −0.0366 |
| | (1.0401) | (1.5181) | (0.8829) | (1.1595) |
| N | 927 | 877 | 864 | 892 |
| R2 | 0.0580 | 0.0771 | 0.1179 | 0.1944 |
| Adjusted R2 | 0.0351 | 0.0522 | 0.0937 | 0.1731 |
| Prob > F | 0.0000 | 0.0000 | 0.0000 | 0.0000 |

**Table A2**
Econometrics Results of Log Odds Ratio Model. Dependent Variable: KAP Children

| | (1) | (2) | (3) | (4) | (5) |
|---|---|---|---|---|---|
| | Knowledge | Attitudes | Practices - Lunch Box | Practices - Consumption | Practices - Recycling |
| *KAP* | | | | | |
| Knowledge Parents | 0.3631*** | | | | |
| | (0.1210) | | | | |
| Knowledge Children | | 0.3693* | 0.3089** | 0.4123*** | −0.1985 |
| | | (0.1906) | (0.1317) | (0.1407) | (0.1466) |
| Attitudes Parents | | 0.0600 | | | |
| | | (0.1347) | | | |
| Attitudes Children | | | 0.1895** | 0.2001* | 0.1158 |
| | | | (0.0870) | (0.1069) | (0.0996) |
| Practices - Lunch Box Parents | | | 0.1787*** | | |
| | | | (0.0517) | | |
| Practices - Consumption Parents | | | | 0.1054 | |
| | | | | (0.0903) | |
| Practices - Recycling Parents | | | | | 0.1581** |
| | | | | | (0.0720) |
| *Household's Characteristics* | | | | | |
| Dummy Parents - guardian | 0.0556 | −0.0840 | −0.0121 | −0.0247 | −0.1277 |
| | (0.0740) | (0.1616) | (0.1083) | (0.1107) | (0.1374) |
| Age of guardian | −0.0148 | −0.0039 | 0.0147 | −0.0290 | 0.0157 |
| | (0.0140) | (0.0307) | (0.0199) | (0.0232) | (0.0266) |
| Sqrt(Age of guardian) | 0.0002 | 0.0000 | −0.0002 | 0.0004 | −0.0002 |
| | (0.0002) | (0.0004) | (0.0003) | (0.0003) | (0.0003) |
| Household size [No.] | −0.0190* | −0.0139 | −0.0067 | −0.0326* | 0.0115 |
| | (0.0100) | (0.0196) | (0.0130) | (0.0170) | (0.0147) |
| Involvement in children's education [index] | −0.0434 | 0.3175 | −0.0645 | −0.1917 | −0.0366 |
| | (0.0958) | (0.2073) | (0.1709) | (0.1758) | (0.1698) |
| Mother's formal education [years] | 0.0034 | −0.0069 | 0.0013 | −0.0014 | −0.0008 |
| | (0.0054) | (0.0111) | (0.0084) | (0.0105) | (0.0101) |
| Father's formal education [years] | 0.0047 | 0.0137 | −0.0021 | 0.0072 | 0.0045 |
| | (0.0053) | (0.0100) | (0.0074) | (0.0078) | (0.0083) |
| ln(Household's income) | 0.0016 | −0.0041 | 0.0144 | 0.1141*** | −0.0180 |
| | (0.0271) | (0.0591) | (0.0365) | (0.0436) | (0.0393) |
| *Children's Characteristics* | | | | | |
| Gender (male) | −0.0218 | −0.0837 | 0.0240 | 0.0074 | −0.0451 |
| | (0.0235) | (0.0511) | (0.0345) | (0.0388) | (0.0399) |
| Children's Experience 1 | | 0.2290*** | −0.0084 | 0.1417** | 0.1376* |
| | | (0.0873) | (0.0538) | (0.0696) | (0.0745) |
| Children's Experience 2 | | −0.0599 | −0.0867** | 0.0020 | −0.1287*** |
| | | (0.0587) | (0.0418) | (0.0458) | (0.0495) |
| Children's Experience 3 | | 0.1394** | 0.0544 | −0.0287 | 0.0075 |

(*continued on next page*)

**Table A2** (*continued*)

| | (1) | (2) | (3) | (4) | (5) |
|---|---|---|---|---|---|
| | Knowledge | Attitudes | Practices - Lunch Box | Practices - Consumption | Practices - Recycling |
| | | (0.0577) | (0.0376) | (0.0454) | (0.0466) |
| Children's Experience 4 | | 0.0443 | 0.1238*** | 0.0442 | 0.2759*** |
| | | (0.0503) | (0.0345) | (0.0398) | (0.0398) |
| Student's Altruism Level | | 0.0086 | 0.0144** | 0.0464*** | 0.0530*** |
| | | (0.0106) | (0.0068) | (0.0088) | (0.0076) |
| *School's Characteristics* | | | | | |
| Dummy Private-voucher School | 0.1007*** | −0.0870 | −0.0756 | 0.0455 | 0.0903* |
| | (0.0294) | (0.0708) | (0.0485) | (0.0490) | (0.0502) |
| Dummy Private-paid School | 0.0100 | −0.4758*** | 0.1520* | 0.0953 | 0.1744* |
| | (0.0550) | (0.1223) | (0.0880) | (0.0985) | (0.0960) |
| ln(SIMCE) | 0.3792* | 0.7228 | −0.4320 | −0.0076 | 0.2985 |
| | (0.2188) | (0.4848) | (0.3917) | (0.3620) | (0.4162) |
| Basic environmental certification | −0.0100 | −0.1434* | −0.0686 | −0.0571 | −0.0455 |
| | (0.0372) | (0.0765) | (0.0517) | (0.0532) | (0.0566) |
| Medium environmental certification | 0.0152 | −0.1653* | −0.0608 | −0.0363 | 0.0081 |
| | (0.0438) | (0.0939) | (0.0670) | (0.0711) | (0.0754) |
| Coastal Commune | 0.0222 | 0.0413 | 0.1352*** | 0.0804* | −0.0110 |
| | (0.0265) | (0.0564) | (0.0386) | (0.0429) | (0.0433) |
| Constant | −1.6216 | −3.5890 | 2.3400 | −0.8196 | −1.8235 |
| | (1.3666) | (2.9228) | (2.4821) | (2.2895) | (2.5458) |
| N | 1065 | 653 | 766 | 869 | 870 |
| R2 | 0.0612 | 0.0958 | 0.1106 | 0.1453 | 0.1559 |
| Adjusted R2 | 0.0469 | 0.0642 | 0.0831 | 0.1221 | 0.1329 |
| Prob > F | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |

*Note*: *p < 0.1; **p < 0.05; ***p < 0.01. Robust standard errors in parenthesis.

## References


Acock, A. C., & Bengtson, V. E. (1980). Socialization and attribution processes: Actual vs. perceived similarity among parents and youth. *Journal of Marriage and Family, 40*, 519–530.

Alp, E., Ertepinar, H., Tekkaya, C., & Yilmaz, A. (2008). A survey on Turkish elementary school students' environmental friendly behaviours and associated variables. *Environmental Education Research, 14*(2), 129–143. https://doi.org/10.1080/13504620802051747

Alpizar, F., Carlsson, F., Lanza, G., Carney, B., Almroth, R., Jaime, M., Ho, T., Nie, Z., Salazar, C., Tibesigwa, B., & Wahdera, S. (2020). A framework for selecting and designing policies to reduce marine plastic pollution in developing countries. *Environmental Science & Policy, 109*, 25–35. https://doi.org/10.1016/j.envsci.2020.04.007

Alzghoul, B., & Abdullah, N. (2015). Pain management practices by nurses: An application of the knowledge, attitude and practices (KAP) model. *Global Journal of Health Science, 8*(6), 154. https://doi:10.5539/gjhs.v8n6p154.

Ando, K., Yorifuji, K., Ohnuma, S., Matthies, E., & Kanbara, A. (2014). Transmitting pro-environmental behaviours to the next generation: A comparison between Germany and Japan. *Asian Journal of Social Psychology, 18*(2), 134–144.

Awang Besar, T., Hassan, M., Bolong, J., & Abdullah, R. (2013). Exploring the levels of knowledge, attitudes and environment-friendly practices among young civil servants in Malaysia. *Pertanika Journal of Social Sciences & Humanities, 21*(spec. July), 21–38.

Bandura, A. (1986). *Social foundations of thought and action*. Englewood Cliffs, NJ: Prentice Hall.

Barboza, L. G. A., Dick Vethaak, A., Lavorante, B. R. B. O., Lundebye, A.-K., & Guilhermino, L. (2018). Marine microplastic debris: An emerging issue for food security, food safety and human health. *Marine Pollution Bulletin, 133*, 336–348. https://doi.org/10.1016/j

Blankenberg, A., & Alhusen, H. (2019). *On the determinants of pro-environmental behavior: A literature review and guide for the empirical economist*. CEGE Discussion Papers No. 350. Available at: http://hdl.handle.net/10419/204821.

Bohner, G., & Wanke, M. (2002). *Attitudes and attitude change*. East Sussex, *United Kingdom*: Psychology Press. https://doi.org/10.4324/9781315784786

Boudet, H., Ardoin, N. M., Flora, J., Armel, K. C., Desai, M., & Robinson, T. N. (2016). Effects of a behaviour change intervention for Girl Scouts on child and parent energy-saving behaviours. *Nature Energy, 1*(8), 1–10. https://doi.org/10.1038/nenergy.2016.91

Cardwell, F. (2011). *Knowledge, attitudes and practices of global environment change and health: Toward sustainable behavior change? Master thesis*. Hamilton: McMaster University.

Carneiro, P., Meghir, C., & Parey, M. (2013). Maternal education, home environments, and the development of children and adolescents. *Journal of the European Economic Association, 11*(suppl_1), 123–160. https://doi.org/10.1111/j.1542-4774.2012.01096.x

Casaló, L. V., & Escario, J. J. (2016). Intergenerational association of environmental concern: Evidence of parents' and children's concern. *Journal of Environmental Psychology, 48*, 65–74. https://doi.org/10.1016/j.jenvp.2016.09.001

Chawla, L., & Derr, V. (2012). The development of conservation behaviors in childhood and youth. In S. D. Clayton (Ed.), *The Oxford handbook of environmental and conservation psychology* (pp. 527–555). New York, NY: Oxford University 743 Press. https://doi.org/10.1093/oxfordhb/9780199733026.013.0028.

Cheng, J. C., & Monroe, M. C. (2012). Connection to nature: Children's affective attitude toward nature. *Environment and Behavior, 44*, 31–49. https://doi.org/10.1177/2F0013916510385082

Chevalier, A., Harmon, C., O'Sullivan, V., & Walker, I. (2013). The impact of parental income and education on the schooling of their children. *IZA Journal of Labor Economics, 2*(1), 1–22.

Clark, C., Kotchen, M., & Moore, M. (2003). Internal and external influences on pro-environmental behavior: Participation in a green electricity program. *Journal of Environmental Psychology, 23*(3), 237–246.

Collado, S., & Corraliza, J. A. (2015). Children's restorative experiences and self-reported pro-environmental behaviors. *Environment and Behavior, 47*, 38–56. https://doi.org/10.1177/0013916513492417

Collado, S., Evans, G. W., & Sorrel, M. A. (2017). The role of parents and best friends in children's pro-environmentalism: Differences according to age and gender. *Journal of Environmental Psychology, 54*, 27–37. https://doi.org/10.1016/j.jenvp.2017.09.007

Cordier, M., Uehara, T., Baztan, J., Jorgensen, B., & Yan, H. (2021). Plastic pollution and economic growth: The influence of corruption and lack of education. *Ecological Economics, 182*, 1–14. https://doi.org/10.1016/j.ecolecon.2020.106930

Da Silva, P. (2015). Conservation of mangroves in Guyana: A study of teacher's perceptions, knowledge, attitudes and practices. *Research Journal of Chemical and Environmental Sciences, 3*(4), 1–8.

Dickson, M., Gregg, P., & Robinson, H. (2016). Early, late or never? When does parental education impact child outcomes? *The Economic Journal, 126*(596), 184–231. https://doi.org/10.1111/ecoj.12356

Donahue, A. K., & Miller, J. M. (2006). Experience, attitudes, and willingness to pay for public safety. *The American Review of Public Administration, 36*, 395–418. https://doi.org/10.1177/0275074005285666

Duvall, J., & Zint, M. (2007). A review of research on the effectiveness of environmental education in promoting intergenerational learning. *The Journal of Environmental Education, 38*(4), 14–24.

Ekström, K. (2007). Parental consumer learning or 'keeping up with the children. *Journal of Consumer Behaviour: International Research and Review, 6*(4), 203–217.

Estrada, A., Hess, R., & Holloway, S. (1987). Affective quality of the mother–child relationship: Longitudinal consequences for children's school-relevant cognitive functioning. *Developmental Psychology, 23*(2), 210–215.

Evans, G., Brauchle, G., Haq, A., Stecker, R., Wong, K., & Shapiro, E. (2007). Young children's environmental attitudes and behaviors. *Environment and Behavior, 39*(5), 635–658.

Evans, G., Otto, S., & Kaiser, F. (2018). Childhood origins of young adult environmental behavior. *Psychological Science, 29*(5), 679–687.

FAO. (2017). *Microplastics in fisheries and aquaculture*. Fisheries and Aquaculture Technical Paper 615 http://www.fao.org/3/a-i7677e.pdf.

Fehr, E., Glätzle-Rützler, D., & Sutter, M. (2013). The development of egalitarianism, altruism, spite and parochialism in childhood and adolescence. *European Economic Review, 64*, 369–383. https://doi.org/10.1016/j.euroecorev.2013.09.006

Fernández-Manzanal, R., Serra, L., Morales, M., Carrasquer, J., Rodríguez-Barreiro, L., del Valle, J., & Murillo, M. (2015). Environmental behaviours in initial professional

development and their relationship with university education. *Journal of Cleaner Production, 108*, 830–840. https://doi.org/10.1016/j.jclepro.2015.07.153. Part A.
Fruehwirth, J. C., & Gagete-Miranda, J. (2019). Your peers' parents: Spillovers from parental education. *Economics of Education Review, 73*, 101910. https://doi.org/10.1016/j.econedurev.2019.101910
Fujii, S. (2006). Environmental concern, attitude toward frugality, and ease of behavior as determinants of pro-environmental behavior intentions. *Journal of Environmental Psychology, 26*(4), 262–268.
Gadzekpo, A., Tietaah, G., & Segtub, M. (2018). Mediating the climate change message: Knowledge, attitudes and practices (KAP) of media practitioners in Ghana. *African Journalism Studies, 39*(3), 1–23. https://doi.org/10.1080/23743670.2018.146783
Garling, T., Fujii, S., Garling, A., & Jakobsson, C. (2003). Moderating effects of social value orientation on determinants of proenvironmental behavior intention. *Journal of Environmental Psychology, 23*(1), 1–9.
Grønhøj, A. (2006). Communication about consumption: A family process perspective on "green" consumer practices. *Journal of Consumer Behaviour, 5*(6), 491–503.
Grønhøj, A., & Thøgersen, J. (2009). Like father, like son? Intergenerational transmission of values, attitudes, and behaviors in the environmental domain. *Journal of Environmental Psychology, 29*(4), 414–421. https://doi.org/10.1016/j.jenvp.2009.05.002
Grønhoj, A., & Thøgersen, J. (2012). Action speaks louder than words: The effect of personal attitudes and family norms on adolescents' pro-environmental behaviour. *Journal of Environmental Psychology, 33*(1), 292–302. https://doi:10.1016/j.joep.2011.10.001.
Grønhøj, A., & Thøgersen, J. (2017). Why young people do things for the environment: The role of parenting for adolescents' motivation to engage in pro-environmental behaviour. *Journal of Environmental Psychology, 54*(1), 11–19.
Guastello, D., & Peissig, R. (1998). Authoritarianism, environmentalism, and cynicism of college students and their parents. *Journal of Research in Personality, 32*, 297–410.
Gutierrez-Karp. (1996). Values and their effect on pro-environmental behavior. *Environment and Behavior, 28*(1), 111–133.
Hai, L., Hai, P., Dung, T., & Hens, L. (2010). Influencing factors on sustainable development: A case study in quang tri province, Vietnam. *Environment, Development and Sustainability, 12*(1), 103–116.
Hartley, B. L., Pahl, S., Holland, M., Alampei, I., Veiga, J. M., & Thompson, R. C. (2018). Turning the tide on trash: Empowering European educators and school students to tackle marine litter. *Marine Policy, 96*, 227–334. https://doi.org/10.1016/j.marpol.2018.02.002
Hartley, B. L., Thompson, R. C., & Pahl, S. (2015). Marine litter education boosts children's understanding and self-reported actions. *Marine Pollution Bulletin, 90*(1–2), 209–217. https://doi.org/10.1016/j.marpolbul.2014.10.049
Heimlich, J. E., & Ardoin, N. M. (2008). Understanding behavior to understand behavior change: A literature review. *Environmental Education Research, 14*(3), 215–237. https://doi.org/10.1080/13504620802148881
Hoang, T. T. P., & Kato, T. (2016). Measuring the effect of environmental education for sustainable development at elementary schools: A case study in Da Nang city, Vietnam. *Sustainable Environment Research, 26*(6), 274–286. https://doi.org/10.1016/j.serj.2016.08.005
Jambeck, J. R., Geyer, R., Wilcox, C., Siegler, T. R., Perryman, M., Andrady, A., & Law, K. L. (2015). Plastic waste inputs from land into the ocean. *Science, 347*(6223), 768–771. https://doi.org/10.1126/science.1260352
Johar, F., & Razak, M. (2015). The right attitude to sustain the green neighbourhoods. *Procedia - Social and Behavioral Sciences, 202*, 135–143.
Karami, S., Shobeiri, S., Jafari, H., & Jafari, H. (2017). Assessment of knowledge, attitudes, and practices (KAP) towards climate change education (CCE) among lower secondary teachers in Tehran, Iran. *International Journal of Climate Change Strategies and Management, 9*(3), 402–415. https://doi.org/10.1108/IJCCSM-04-2016-0043
Katz-Gerro, T., Greenspan, I., Handy, F., & Vered, Y. (2020). Environmental behavior in three countries: The role of intergenerational transmission and domains of socialization. *Journal of Environmental Psychology, 71*, 101343.
Kioko, J., & Kiringe, J. (2010). Youth's knowledge, attitudes and practices in wildlife and environmental conservation in Maasai land, Kenya. *Southern African Journal of Environmental Education, 27*, 91–101.
Larsson, B., Andersson, M., & Osbeck, C. (2010). Bringing environmentalism home. *Childhood, 17*(1), 129–147. https://doi.org/10.1177/2F0907568209351554
Lawson, D., Stevenson, K., Peterson, M., Carrier, S., Strnad, R., & Seekamp, E. (2018). Intergenerational learning: Are children key in spurring climate action? *Global Environmental Change, 53*, 204–208.
Leppänen, J. M., Haahla, A. E., Lensu, A. M., & Kuitunen, M. T. (2012). Parent-child similarity in environmental attitudes: A pairwise comparison. *The Journal of Environmental Education, 43*(3), 162–176. https://doi.org/10.1080/00958964.2011.634449
Levine, D. S., & Strube, M. J. (2012). Environmental attitudes, knowledge, intentions and behaviors among college students. *The Journal of Social Psychology, 152*(3), 308–326. https://doi.org/10.1080/00224545.2011.604363
Lévy-Leboye, C., Bonnes, M., Chase, J., Ferreira-Marques, J., & Pawlik, K. (1996). Determinants of pro-environmental behaviors. *European Psychologist, 1*, 123–129.
Lindeboom, M., Llena-Nozal, A., & van Der Klaauw, B. (2009). Parental education and child health: Evidence from a schooling reform. *Journal of Health Economics, 28*(1), 109–131. https://doi.org/10.1016/j.jhealeco.2008.08.003
Liu, H., Xu, X., Liu, D., Rao, Y., Reis, C., Sharma, M., & Zhao, Y. (2018). Nutrition-related knowledge, attitudes, and practices (KAP) among kindergarten teachers in Chongqing, China: A cross-sectional survey. *International Journal of Environmental Research and Public Health, 15*(4), 615. https://doi:10.3390/ijerph15040615.
Maccoby, E. E. (2007). Historical overview of socialization research and theory. In J. E. Grusec, & P. D. Hastings (Eds.), *Handbook of socialization: Theory and research* (pp. 13–41). New York, NY: Guilford.
Maddox, P., Doran, C., Williams, I. D., & Kus, M. (2011). The role of intergenerational influence in waste education programmes: The THAW project. *Waste Management, 31*(12), 2590–2600.
Mansaray, A., Ajiboye, J., & Audu, U. (1998). Environmental knowledge and attitudes of some Nigerian secondary school teachers. *Environmental Education Research, 4*(3), 329–339.
Matthies, E., Selge, S., & Klöckner, C. A. (2012). The role of parental behaviour for the development of behaviour specific environmental norms – the example of recycling and re-use behaviour. *Journal of Environmental Psychology, 32*(3), 277–284. https://doi:10.1016/j.jenvp.2012.04.003.
Meeusen, C. (2014). The intergenerational transmission of environmental concern: The influence of parents and communication patterns within the family. *The Journal of Environmental Education, 45*(2), 77–90. https://doi.org/10.1080/00958964.2013.846290
Mlipha, M., & Manyatsi, D. (2005). Environmental knowledge, attitudes and practices of secondary and high school teachers in Swaziland. *Southern African Journal of Environmental Education, 22*, 137–150.
Moschis, G. (1987). *Consumer socialization – a life-cycle perspective*. Lexington, MA: Lexington Books.
National oceanic and atmospheric administration NOAA. (2015). *Turning the tide on trash: A learning guide on marine debris. Marine debris program*. https://marinedebris.noaa.gov/turning-tide-trash.
Owens, K. A. (2018). Using experiential marine debris education to make an impact: Collecting debris, informing policy makers, and influencing students. *Marine Pollution Bulletin, 127*, 804–810.
Pe'er, S., Goldman, D., & Yavetz, B. (2007). Environmental literacy in teacher training: Attitudes, knowledge, and environmental behavior of Beginning students. *The Journal of Environmental Education, 39*(1), 45–59. https://doi.org/10.3200/JOEE.39.1.45-59
Salas-Zapata, W. A., Ríos-Osorio, L. A., & Cardona-Arias, J. A. (2018). Knowledge, attitudes and practices of sustainability: Systematic review 1990–2016. *Journal of Teacher Education for Sustainability, 20*(1), 46–63.
Schultz, P., & Kaiser, F. (2012). *Promoting pro-environmental behavior*. The Oxford Handbook of Environmental and Conservation Psychology. https://psycnet.apa.org/doi/10.1093/oxfordhb/9780199733026.013.0029.
Smyth, E., Caamano, F., & Fernandez-Riveiro, P. (2017). Oral health knowledge, attitudes and practice in 12-year-old schoolchildren. *Journal of International Society of Preventive and Community Dentistry, 12*(8), 614–620.
Sutter, M., Zoller, C., & Glätzle-Rützler, D. (2019). Economic behavior of children and adolescents–A first survey of experimental economics results. *European Economic Review, 111*, 98–121. https://doi.org/10.1016/j.euroecorev.2018.09.004
Tessnow-von Wysocki, I., & Le Billon, P. (2019). Plastics at sea: Treaty design for a global solution to marine plastic pollution. *Environmental Science & Policy, 100*, 94–104. https://doi.org/10.1016/j.envsci.2019.06.005
Turaga, R., Howarth, R., & Borsuk, M. (2010). Pro-environmental behavior: Rational choice meets moral motivation. *Annals of the New York Academy of Sciences, 1185*, 211–224. https://doi.org/10.1111/j.1749-6632.2009.05163.x
Valente, T., Paredes, P., & Poppe, P. (1998). Matching the message to the process. The relative ordering of knowledge, attitudes, and practices in behavior change research. *Human Communication Research, 24*(3), 366–385. https://doi:10.1111/j.1468-2958.1998.tb00421.x.
Verplanken, B. (2018). In B. Verplanken (Ed.), *The Psychology of Habit: Theory, mechanisms, change, and contexts*. Springer.
Verplanken, B., & Orbell, S. (2019). Habit and behavior change. In K. Sassenberg, & M. Vliek (Eds.), *Social psychology in action* (pp. 65–78). Cham: Springer.
Verplanken, B., & Whitmarsh, L. (2021). Habit and climate change. *Current Opinion in Behavioral Sciences, 42*, 42–46.
Wan Nuríashiqin, W., Er, A., Ali, N., Lyndon, N., & Hashim, H. (2011). Diagnosing knowledge, attitudes and practices for a sustainable campus. *World Applied Sciences Journal, 13*(13), 93–98.
Wan, T., Rav-Marathe, K., & Marathe, S. (2016). A Systematic Review of KAP-O framework for diabetes. *Medical Research Archives, 3*(9). apr. 2016. ISSN 2375-1924. Available at: https://esmed.org/MRA/mra/article/view/483.
Whitbeck, L., & Gecas, V. (1988). Value attributions and value transmission between parents and children. *Journal of Marriage and Family, 50*(3), 829–840.
Williams, S., McLean, L., & Quinn, N. (2017). As the climate changes: Intergenerational action-based learning in relation to flood education. *The Journal of Environmental Education, 48*(3), 154–171.
Wood, W., & Rünger, D. (2016). Psychology of habit. *Annual Review of Psychology, 67*, 289–314.