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Parents who want their PreK children to have science learning experiences are outliers

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ABSTRACT

The purpose of this study was to examine parental priorities regarding science education in the early years. The study sample included 1456 Turkish parents of pre-K children (36–72 months). Parents were asked to prioritize eight academic content areas, including science, in descending order. The results demonstrated that the number of parents who prioritized science over other academic content areas in pre-K classrooms was quite low. Parents who ranked science highly deviated from the whole sample and almost all of these parents were identified as outliers by the two-step cluster analysis. Parents of boys and younger children and parents with high-SES level were more likely to prioritize science over other academic content areas. The findings suggest that parental preferences overall align well with early childhood teachers' tendency to teach less science than other content areas, and parental priorities might be another major factor that contributes to limited science learning experiences in the early years.

1. Introduction

Science education in early childhood classrooms has been largely under represented in preschool curricula and early learning experiences. Children have fewer opportunities to learn science than literacy, mathematics, social studies, and arts in typical early childhood classrooms (Bracken & Fischel, 2006; Early et al., 2010; Greenfield et al., 2009; Nayfeld, Brenneman, & Gelman, 2011; Saçkes, Trundle, Bell, & O'Connell, 2011; Varol, 2013). Most early childhood teachers teach science only once or twice per week, resulting in very limited time for science learning (Saçkes et al., 2011) and teachers tend to focus on teaching life science concepts more than physical and earth and space science concepts (Saçkes, in press).

The reasons for the limited visibility of science learning experiences in early childhood classrooms to date have been examined solely from the teacher's perspectives. These studies have identified several factors that prevent early childhood teachers from providing effective science learning experiences for young children. Studies have demonstrated that several factors influence early childhood teachers' decisions to devote less time in teaching science in their classrooms. These factors include: (1) limited science and pedagogical content knowledge (Appleton, 1992; Kallery & Psillos, 2001; Saçkes, in press), (2) pressure to teach content areas other than science (Greenfield et al., 2009; Nayfeld et al., 2011), (3) limited availability of science-related materials (Appleton & Kindt, 1999; Early et al., 2010; Greenfield et al., 2009), (4) perceptions that young children are incapable of learning science concepts (Fleer, 2009; Saçkes, in press), (5) and low teacher self-efficacy for teaching science (Appleton, 1995; Garbett, 2003; Greenfield et al., 2009; Kallery & Psillos, 2001; Maier, Greenfield, & Bulotsky-Shearer, 2013; Nayfeld et al., 2011; Pell & Jarvis, 2003).

An increasing number of studies have examined how often early childhood teachers teach science concepts and the factors that influence teachers' decisions to teach science in the early years (Saçkes, in press). Studies suggest that parental support for science learning in school and at home promotes children's interest in science and conceptual understanding of scientific phenomena (Alexander, Johnson, & Kelly, 2012; Mantzicopoulos, Patrick, & Samarapungavan, 2013; Tenenbaum, Snow, Roach, & Kurland, 2005). Positive experiences with learning science in school might influence parents' beliefs about teaching and learning science in the early years. Parents with affirming learning experiences might have a positive attitude toward learning science and have the resources to support their own children's learning of science (Chen, 2001; Dierking & Falk, 1994; Ferry, Fouad, & Smith, 2000; George & Kaplan, 1998; Kaya & Lundeen, 2010; Zady & Portes, 2001). Parents' beliefs about the importance and appropriateness of learning science may influence the quality and the quantity of science learning opportunities children receive at home and in school. However, parents' perceptions of the importance of science learning in comparison to other academic content areas have not been examined in the literature. Therefore, the current study aims to fill the gap in the literature via examining parents' preferences for learning science

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in early childhood classrooms compared to other academic content areas.

1.1. Parents' priorities for preschool and kindergarten curriculum

Parental priorities for early childhood curriculum have been extensively studied in the literature. For example, the findings of the studies conducted in Hong Kong, Australia, and U.S. have demonstrated that parents are more likely than early childhood teachers to focus on academic learning (Dockett & Perry, 2004; Ebbeck, 1995; Knudsen-Lindauer & Harris, 1989). More specifically, parents are inclined to rank reading, writing, and mathematics as being more important than do teachers of young children (Hewitt & Maloney, 2000; Knudsen-Lindauer & Harris, 1989). American fathers tend to emphasize academic learning more than mothers and parents' academic expectations for girls were found to be higher than boys (McBride & Ferguson, 1992). Parents of older preschoolers tend to perceive academic skills as more important than the parents of younger preschoolers in Hong Kong (Fung & Cheng, 2012). Likewise, parents with low socioeconomic status and minority parents tend to focus more on academic learning than non-minority parents and those of higher socioeconomic statuses (Evans & Fuller, 1998; Harding, 2006; Kernan & Hayes, 1999; Ojala, 2000; Piotrkowski, Botsko, & Matthews, 2000). Researchers also have identified cross-cultural differences in parents' expectations and priorities. For example American, Chinese, Malaysian, and Irish parents of pre-K children tend to focus more on academic learning than Swedish, Finnish, Icelandic, and Japanese parents (Einarsdóttir, 2010; Hewitt & Maloney, 2000; Ojala, 2000; Tobin, Wu, & Davidson, 1991). Children's acquisition of moral and ethical values and behaviors also is considered as an important educational goal in the early years (Brownlee et al., 2012; LePage et al., 2011; Luo, Tamis-LeMonda, & Song, 2013). Turkish parents expect their children to acquire moral values early in their lives (Nacak, Yağmurlu, Durgel, & van de Vijver, 2011). The findings of a recent study with Turkish parents of preschool age children demonstrated that a majority of the parents expects schools to provide systematic moral education in preschool classrooms (Balat, Beceren, & Özdemir, 2011).

Although parents of pre-K children perceive social and emotional development as important areas to be targeted in early childhood classrooms, they tend to favor cognitive development and related academic skills more than other areas. Even parents who report that their children's social emotional development is the primary reason that they send them to preschool tend to prefer activities that support academic learning in pre-K classrooms, and they perceive academic and cognitive development as the primary outcomes of preschool education (Hewitt & Maloney, 2000).

In studies that examine parents' expectations and priorities for early childhood programs, reading, writing, and mathematics are the only academic skills parents are typically asked to rank or rate among a list of other skills (Kernan & Hayes, 1999; Knudsen-Lindauer & Harris, 1989). No previous studies included science as an option for parents to consider or examined how parents prioritize science among other academic content areas. The findings of only one recent study provide a glimpse of what parents might think about the place of science learning in early childhood curriculum. While the literacy and mathematics activities were the most preferred learning experiences parents wanted for their children, activities that have a potential to promote scientific thinking such as sand play and water play were the least preferred activities by the Malaysian parents surveyed in that study (Hewitt & Maloney, 2000).

Greenfield et al. (2009) suggested that preschool science education is an emerging research area and basic studies that provide preliminary empirical data should be conducted. These researchers suggest that future research in this area should focus on understanding the reasons science is not targeted in early childhood classrooms and propose that teacher-related variables, such as self-efficacy and time-constraints, and developing instruments to assess preschool science readiness and quality should be major research topics (Greenfield et al., 2009). A neglected factor in this proposed research agenda is an examination of parents' expectations and priorities for science in early childhood programs. Although early childhood teachers' beliefs, their classroom practices, and the child-related factors are important components, parental involvement, expectations, and priorities regarding science education in the early years should also be included in such an agenda (Ginsburg & Golbeck, 2004).

1.2. Early childhood science education

A large body of literature provides evidence that children develop ideas, although mostly divergent from scientific accounts, about how the natural world works very early in their lives. For example, studies revealed that children have naïve ideas about night and day cycle, the shape of the earth, the moon phases, distinction between living and nonliving things, properties of physical objects, light and shadows, and the mechanism of rainfall (Carey, 1985; Hannust & Kikas, 2007; Hobson, Trundle, & Sackes, 2010; Krnel, Watson, & Glazar, 2005; Saçkes, Flevares, & Trundle, 2010; Segal & Cosgrove, 1993; Venville, 2004; Vosniadou & Brewer, 1992; Vosniadou & Brewer, 1994). Collectively, findings from these studies demonstrated that even preschoolers come to school with intuitive understandings of various natural phenomena. Therefore, researchers suggest that educational experiences for young children should take their prior knowledge into account and provide opportunities to help children in restructuring and constructing their conceptual understandings of science phenomena (Harlen, 2001; Osborne & Freyberg, 1985; Trundle & Saçkes, 2012; Vosniadou, Ioannides, Dimitrakopoulou, & Papademetriou, 2001).

Science education in early childhood classrooms should provide opportunities for children to develop their scientific thinking skills, conceptual understanding of natural phenomena, and positive attitudes toward science (Saçkes et al., 2011; Trundle & Saçkes, 2012). Studies suggest that children's understanding of science concepts and their scientific thinking skills develop successively (Duschl, Schweingruber, & Shouse, 2007; Hmelo-Silver & Duncan, 2009). Early exposure to developmentally appropriate science learning opportunities may promote children's learning of more advanced science concepts and inquiry skills in subsequent years (Saçkes et al., 2011; Tao, Oliver, & Venville, 2012) and help children develop positive attitudes toward science (Mantzicopoulos, Patrick, & Samarapungavan, 2008; Patrick, Mantzicopoulos, & Samarapungavan, 2009), which is linked to later science achievement and STEM-related career choices (Maltese & Tai, 2010; Osborne, Simon, & Collins, 2003).

Contemporary science education literature emphasizes inquiry-based instruction as one of the most effective ways to promote conceptual understandings of scientific phenomena (Anderson, 2002, 2007; Trundle & Saçkes, 2012). Inquiry-based instruction with Pre-K children takes children's existing conceptual understanding into consideration and includes hands-on activities with sense-making discussions where children are encouraged to be physically, mentally, and emotionally active (Saçkes et al., 2011). Inquiry-based instruction with Pre-K children should involve developmentally appropriate structuring and scaffolding such as in formulating research questions and procedures to reduce the amount of cognitive load that may restrain children from constructing conceptual understandings and developing science process skills (Mayer, 2004; Nayfeld et al., 2011; Peterson & French, 2008; Trundle & Saçkes, 2012). In such a learning environment, children

are more likely to develop scientific inquiry skills, construct scientific understandings about natural phenomena, and build an interest in and a positive attitude toward science (Mantzicopoulos et al., 2013; Miller, Smith, Trundle, Saçkes, & Mollohan, 2013; Peterson & French, 2008;). Inquiry-based science instruction can be easily integrated with play, which is considered as an effective and developmentally appropriate pedagogical tool for young learners (Baldwin, Adams, & Kelly, 2009; Bodrova & Leong, 2003; Fleer, 2011; Trawick-Smith, 2012). Although empirical evidence regarding the effectiveness of play in supporting young children's learning of science is scarce, preliminary evidence suggests that inquiry-based play activities may have a potential to promote young children's conceptual understandings of science phenomena (Blake & Howitt, 2012; Fleer, 2009; Miller et al., 2013).

Inquiry-based instruction to teaching science is possibly quite different than what most parents have experienced in their formal schooling, which typically includes traditional or didactic instruction (Kaya & Lundeen, 2010). In traditional forms of instruction, where concepts are presented in final form via verbal explanations and lectures, children remain passive recipient of the information (Trundle, Atwood, Christopher, & Saçkes, 2010). This type of learning environment, unlike inquiry-based instruction, does not offer opportunities for children to test, reflect, and compare their existing conceptual understanding with what emerges in the classroom (Mayer, 2004; Trundle et al., 2010; Vosniadou et al., 2001). Parents who learned science through traditional forms of instruction may perceive the learning of science as the memorization of scientific facts and formulas. Consequently, most parents of young children might believe that teaching science in pre-K classrooms is developmentally inappropriate. Indeed, studies suggest that parents tend to prioritize academic content areas like reading and writing and do not prefer activities that have a potential to promote scientific thinking (Hewitt & Maloney, 2000; Knudsen-Lindauer & Harris, 1989). Therefore, in this study science was predicted to be the least preferred academic content area by parents, and parents who prioritize science were expected to deviate from the whole sample and be identified as outliers in the analysis.

1.3. Parents and early science experiences

Parents help preschool children develop an early understanding of natural phenomena and basic science process skills (Harris & Koenig, 2006; Siegel, Esterly, Callanan, Wright, & Navarro, 2007). Parents promote young children's understanding of biology concepts (Cumming, 2003; Jipson & Callanan, 2003; Rigney & Callanan, 2011), physical science concepts (Tenenbaum & Callanan, 2008; Tenenbaum, Snow, Roach, & Kurland, 2005) and astronomy concepts (Callanan, Jipson, & Soennichsen, 2002) as well as contribute to children's understanding of the domain differences, that is, biological and astronomical phenomena fall into different domains of science (Jipson & Callanan, 2003). During parent-child interactions at home and in informal science learning settings, parents provide guidance and causal explanations to support children's understanding of natural phenomena and the development of their scientific reasoning. During informal science activities, parents purposefully change the type of explanations they provide to accommodate child's age and activity type. For example, parents become more directive with younger children (three years old) during structured activities and when making predictions. However, they become more collaborative with older children (five years old) during open-ended activities and when testing their predictions (Siegel et al., 2007). Parents of boys tend to encourage more detailed scientific reasoning in their sons, and they provide boys more opportunities to respond in discussions of scientific concepts than parents of girls (Crowley, Callanan, Tenenbaum, & Allen, 2001; Tenenbaum & Leaper, 2003; Tenenbaum et al., 2005). Early science learning opportunities provided at home and parental support for science learning are likely to foster children's interest in science, contribute children's learning of science, and promote their comprehension of scientific discourse in early childhood classrooms and beyond (Alexander et al., 2012; Tenenbaum et al., 2005).

By helping children make sense of the natural world around them and by providing relevant educational experiences, parents function as a primary facilitator of young children's early science learning experiences. Although a body of literature has demonstrated the role parents play in offering and enriching informal science learning experiences for young children, our knowledge of what parents think about formal science learning experiences in early childhood classroom is very limited.

1.4. Turkish context

In Turkey, early childhood education services are mainly overseen by the Turkish Ministry of National Education, and with few exceptions, almost all of these services are center-based (Bekman, 2005; Bekman & Göçer, 2005; Kagitcibasi, Sunar, & Bekman, 2001). Starting from the 1990s, early childhood education gained considerable attention as indicated by ongoing efforts for program development and dissemination of early education services (Bekman, 2005). The teacher and topic-centered early childhood program of 1989 have turned into child-centered developmental programs during the years of 1994, 2002 and 2006 (Can-Yasar, Inal, Uyanik, & Kandir, 2011; Güler-Öztürk, 2010). A new program was developed and piloted during the 2012–2013 academic year, and the program will be implemented in subsequent years (Ministry of National Education [MEB], 2012). A decade ago, the schooling rate for early childhood education was about 11% (Bekman, 2005). Since then, the schooling rate has risen to 26.63% and currently about 1,077,933 children (3–5 years old) benefit from public or private early childhood education services (MEB, 2013; Turkish Statistical Institute [TÜİK], 2013).

Although a number of state and non-governmental organizations sponsored campaign efforts has taken place over the last decade to raise public awareness of early childhood education and to increase schooling rates, preschool education still is not a part of compulsory education in Turkey (Bekman & Gürlesel, 2005; MEB, 2011). Even though publicly funded preschools are free of tuition charges, parents need to pay for transportation and nutrition fees, which vary from school to school and may cost as much as $150 per month (MEB, 2004; World Bank, 2013). Considering the current legal minimum wages of approximately $400 per month, most low income families cannot afford to enroll their children in preschool. Therefore, children of low income families, those who need early education services most, are less likely to receive preschool education than their peers from higher income families (Bekman, 2005; World Bank, 2013).

The Turkish early childhood education system suffers from a high child-to-teacher ratio, unbalanced distribution of resources, inadequate funding, a lack of diversity in the types of services offered, and low process quality (Baştürk & Işıkoğlu, 2008; Bekman, 2002, 2005; Derman & Başal, 2010; Kalkan & Akman, 2009; World Bank, 2013). The child-to-teacher ratio is much higher in Turkey than in other countries like the U.S. and Sweden, and it is similar to countries like Korea and China (McMullen et al., 2005; Sheridan, Giota, Han, & Kwon, 2009). As in Portugal, Sweden and Germany, self-care skills and motor skills are highly emphasized in Turkish early childhood classrooms, whereas diversity and multicultural values are not commonly addressed (Baştürk & Işıkoğlu, 2008; Saçkes, 2013; Sheridan et al., 2009; Tietze, Cryer, Bairrão, Palacios, & Wetzel, 1996). Similar to the U.S., Finland, and Korea, variations in the quality of the services offered in Turkish early childhood

education institutions appear to be high (Bekman, 2002; Hujala, Fonsén, & Elo, 2012; Sheridan et al., 2009; Tietze et al., 1996). Like most European countries, a bachelor's degree is required to serve as an early childhood education teacher in publicly funded Turkish preschools (Kayhan & Kılıç, 2011). Yet, high school graduates and associate degree holders in child development commonly serve in institutions not overseen by the Ministry of National Education, and this difference in teacher training contributes to the observed variations in the quality of the early education services (Bekman, 2005).

Turkish early childhood teachers' beliefs about teaching young children appear to be aligned well with the Developmentally Appropriate Practices of the National Association for the Education of Young Children (NAEYC) (Erdiller, 2013; Erdiller & McMullen, 2004). However, the congruence between Turkish early childhood teachers' beliefs and their classroom practices is weaker than their colleagues in the U.S., Taiwan, and Korea, but higher than China (McMullen et al., 2005). Turkish early childhood teachers' actual classroom practices deviate from the Developmentally Appropriate Practices of NAEYC for several reasons: limited physical resources, high child-to-teacher ratio, limited perceived parental and collegial support, and the collectivist tone of Turkish culture, or more aptly culture of relatedness (Erdiller, 2013; Erdiller & McMullen, 2004; Kagitcibasi, 2005; McMullen et al., 2005).

Like Sweden and South Korea, Turkey has a national early childhood education program and early education services are regulated by the centralized government (Sheridan et al., 2009). The Turkish early childhood education program is a developmental program and the program does not include early learning content standards for the preschool and kindergarten level (Saçkes et al., 2010). The program targets the development of self-care skills and socio-emotional, cognitive, motor, and language development of children (MEB, 2012). Even though the development of some science process skills, such as making observations and establishing a cause and effect relationship, are targeted in the program, the program does not explicitly focus on developing conceptual understandings of basic science concepts in children.

In typical Turkish preschool and kindergarten classrooms, very little time is allocated for science activities (Ayvacı, Devecioğlu, & Yiğit, 2002; Özbey & Alisinanoğlu, 2008; Varol, 2013). When Turkish early childhood educators do teach science they mostly focus on specific life and space science concepts and utilize teaching strategies that are contrary to the contemporary science education literature (Ayvacı et al., 2002; Güler & Bıkmaz, 2002; Özbey & Alisinanoğlu, 2008; Sığırtmaç & Özbek, 2011). Teachers' limited science and pedagogical content knowledge coupled with their low self-confidence for teaching young children science appear to be major barriers to providing developmentally appropriate science learning opportunities in Turkish pre-K classrooms (Ayvacı et al., 2002; Özbey & Alisinanoğlu, 2008; Saçkes, Akman, & Trundle, 2012).

1.5. Factors Influencing Parents' Priorities

Results of previous studies demonstrated that several factors influence parental expectations and priorities. Past experiences are likely to influence parents' expectations and priorities for pre-K curriculum (Evans & Fuller, 1998). Parents with older children who had previous pre-K experiences might have different priorities for their children than parents with no such experience (Joesch, Maher, & Durfee, 2006; Palacios, 1990). Parents' level of education and income also are likely to influence their expectations and priorities for pre-K curricula. Parents might have different expectations for boys and girls, and parents' expectations might differ based on their children's ages (Chang, Sandhofer, & Brown, 2011; Crowley et al., 2001; Fung & Cheng, 2012; McBride & Ferguson, 1992). Also, parents' residency status (i.e., rural or urban) is likely to influence their expectations for pre-K curricula (Nacak et al., 2011; Palacios, 1990). Parents in rural areas have limited access to resources, such as high quality schools, museums, libraries, and observatories that support the development and education of their children (Aydın, Sarıer, & Uysal, 2012; Shelley & Yildirim, 2013; Tansel, 2002). Limited educational and cultural opportunities in rural areas appear to be associated with children's low performances in language and literacy skills and lower educational attainment (Organization for Economic Co-operation and Development, 2013; Tansel, 2002; Ulubaşoğlu & Cardak, 2007). An unbalanced distribution of educational and cultural resources between urban and rural areas might lead to variations in parental preferences for academic content areas. Parents who reside in rural areas might be more likely to prioritize the acquisition of knowledge and skills (i.e., literacy), which are perceived as fundamental for success in early grades, and they may place less importance on academic content areas (i.e., science), which are associated with success in later grades. Based on the results of these previous studies, analysis of variance was used to examine the extent to which parental priorities for pre-K curricula varied by having an older child with previous pre-K experiences, the number of children in the household, parents' gender and level of education, the family's residency status, and monthly household income, children's gender and age.

1.6. Purpose of the study

This study aimed to investigate parents' perceptions of the place of science education in early childhood curriculum and the socio-demographic factors associated with parental priorities. Based on previous studies on parental priorities for the early childhood curriculum, the number of parents who prioritize science over other academic content areas for their children was predicted to be substantially lower. Also, parents who prioritize science are predicted to deviate from the whole sample and be identified as parents with an unusual response pattern in the analysis.

2. Method

2.1. Participants

The sample of this study included 1456 parents of preschool and kindergarten children (36–72 months) located in a mid-size province in the northwestern part of Turkey. Almost 63% of the participants were from the districts of the province (and about 37% of the participants were from the provincial capital, Balıkesir City, which closely corresponds to the census data (TÜİK, 2012).

The majority of the respondents were mothers (73.5%), while 26.5% of the participants were fathers. The mean age for mothers was 33 years (Median = 32 years) and the mean age for the fathers was 37 years (Median = 36 years). Slightly more than one fourth (27.2%) of the parents were elementary school graduates, 35.6% had a high school degree, 9% had an associate's degree, and 28.3% had a college or post graduate degree. The average monthly household income reported by the parents was 2000TL ($1111 USD) with a median of 1600TL ($888 USD). Less than twenty percent (17.2%) of the parents had children who were three years old, 33.8% of the parents had four-year-old children, and 49% of the parents had children who were five years old. Slightly more than half (51.4%) of the children were boys while 48.6% were girls. Most parents had a single child (50.7%), 43.2% had two children, and a few parents (6.1%) had three or more children.

2.2. Data collection

A questionnaire was developed based on previous research and experts' opinions to examine parental priorities for pre-K curriculum (Kernan & Hayes, 1999; Knudsen-Lindauer & Harris, 1989). A panel of experts with postgraduate degrees in the fields of curriculum and instruction, early childhood education, and psychology were consulted to determine the academic content areas and establish the face validity of the instrument. Readability and the understandability were examined, and the instrument was piloted with 10 parents before data collection. Eight academic content areas were selected for inclusion in the instrument, including mathematics, arts, social studies, science, morals and ethics, pre-reading, pre-writing, and second language. In previous studies that examined parental priorities for learning experiences in early childhood programs, parents are typically asked to rank or rate among a list of learning experiences, activities, content areas, or skills (Hewitt & Maloney, 2000; Kernan & Hayes, 1999; Knudsen-Lindauer & Harris, 1989). A similar procedure was adopted in the present study. Parents were asked to prioritize these eight academic content areas in descending order by ranking the most important academic content area as the first and ranking the least important as the eighth on the questionnaire form. More specifically, parents were asked to respond to the following question which was accompanied by a list of academic content areas in alphabetical order: "Which academic content areas should have priority in your child's pre-K classroom? Please rank the below academic domains in the table by giving 1 to the most important and 8 to the least important academic content areas." The questionnaire also included questions about parents' socio-demographic characteristics. Initially, administrators of educational institutions serving pre-K children within the Balıkesir Province were contacted via an invitation letter that provides information about the study. At the time of the study, there were 32 schools (public and private) serving solely pre-K children in Balıkesir Province and 23 schools agreed to participate in the study. Also, a convenience sample of 25 elementary schools with kindergarten classrooms was included in the study. The schools that agreed to participate in the study granted permission to collect data from the parents. Then, the questionnaire forms along with a letter about the study were distributed to parents who volunteered to participate in the study and the completed forms were retrieved within two to six weeks of distribution.

2.3. Data analysis

In the present study, a cluster analysis procedure was used to reveal clusters of parents with similar preferences for academic domains in the dataset. Cluster analysis is a mathematical method of profiling participants with similar patterns of responses (Aldenderfer & Blashfield, 1984; Hair, Black, Babin, Anderson, & Tatham, 2006). Cluster analysis is an exploratory method that aims to unearth the natural groupings inherent in the data (Jain, 2010). Like factor analysis, cluster analysis aims to detect patterns in the data, but cluster analysis focuses on grouping respondents rather than variables (Hair et al., 2006). This study seeks to identify homogeneous groups of parents with similar priorities for academic content areas. Therefore, cluster analysis was employed in the analysis of the study sample. Two-step cluster analysis was used as the main analytical tool due to its unique advantages over other clustering methods. Two-step cluster analysis can handle both continuous and categorical variables (including dichotomous, ordinal and rank ordered), and it performs well with large samples, has a mechanism to handle outliers, and automatically selects the number of clusters (Chiu, Fang, Chen, Wang, & Jeris, 2001; Norusis, 2012; Řezanková, 2009; Yu, 2010).

Parents were clustered using the log-likelihood distance measure, which is a suitable clustering method for the data in this study (Kaufmann & Rousseeuw, 2005; Řezanková, 2009). The number of clusters was automatically determined by the software using the Bayesian Information Criterion (BIC) as a clustering criterion. The outlier handling option was used to create a separate cluster for parents that did not fit well into any other cluster. The observations were rearranged in random order before the cluster analysis was performed. Following the cluster analysis, chi square analysis and analysis of variance were used to examine whether the parental priorities differ significantly across the clusters as well as the relationship between socio-demographic variables and cluster membership. SPSS version 19 was used in the data analysis.

2.4. Missing data

Initially, the data set was examined for missing values. The percentage of missing values was less than 1% for the dependent variables (parents' ratings of academic content areas). Missing values in the dependent variables were imputed using the Hot Deck imputation technique (Myers, 2011). The Hot Deck imputation technique produces imputations that do not fall outside the range of possible values, which makes it more appropriate than model-based strategies of dealing with missing data, such as maximum likelihood and expectation-maximization, in estimating missing categorical and rank ordered observations (Myers, 2011; Siddique & Belin, 2008). The percentage of missing values was between 1.4% to 4.1% for the independent variables (socio-demographic variables), except for child age (7.6%) and the income variable (16.7%). Missing values in the categorical independent variables were also imputed with Hot Deck imputation technique. The child age and the income variables, however, were imputed using the expectation-maximization (EM) algorithm (Jöreskog & Sörbom, 2006). All cases with missing values were successfully imputed. The analyses were performed on the imputed dataset.

3. Results

3.1. Descriptive statistics

Initially, parents' ranking preferences were examined using descriptive statistics. The percentages of parents' rankings of the academic content areas are illustrated in Fig. 1. Results demonstrated that morals and ethics was the most frequently first-ranked area. Over one-third of the parents (34.3%) selected morals and ethics as their first curricular choice, and the percentage of parents who ranked moral and ethics within their first three choices was 55.2%.

About one-fifth of the parents (21.1%) ranked pre-reading as the most important academic content area, and almost two-thirds of the parents' ranked pre-reading within their first three choices (66.3%). Pre-writing was another of the most highly ranked areas by the parents. Slightly lower than one-fifth of the parents (18.8%) ranked pre-writing as the most important academic skill, and as with the pre-reading, almost two-thirds of the parents ranked pre-writing within their first three choices (65.9%).

Although mathematics was ranked by only 10.9% of the parents as their first choice, the percentage of parents who ranked mathematics within their first three choices was substantial (40%). Pre-reading, pre-writing, morals and ethics, and mathematics were the most highly ranked curricular areas among the parents in this study. Fig. 2 illustrates the percentages for top three rankings.

Science was the least preferred academic content area by the parents. A sizeable number of parents (997 participants, 68.4%) ranked science within their last three choices (6th, 7th, and 8th).

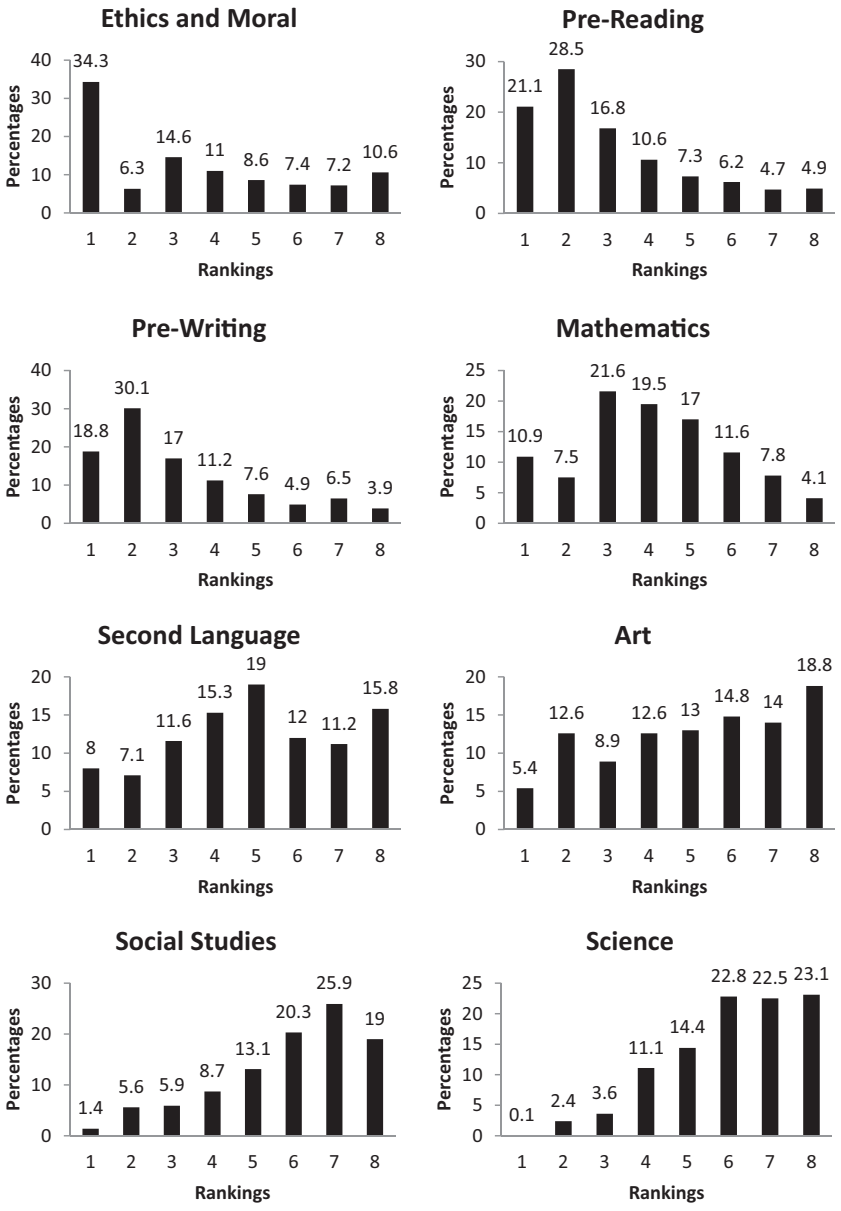

Fig. 1. Percentages of parents' rankings of academic content areas.

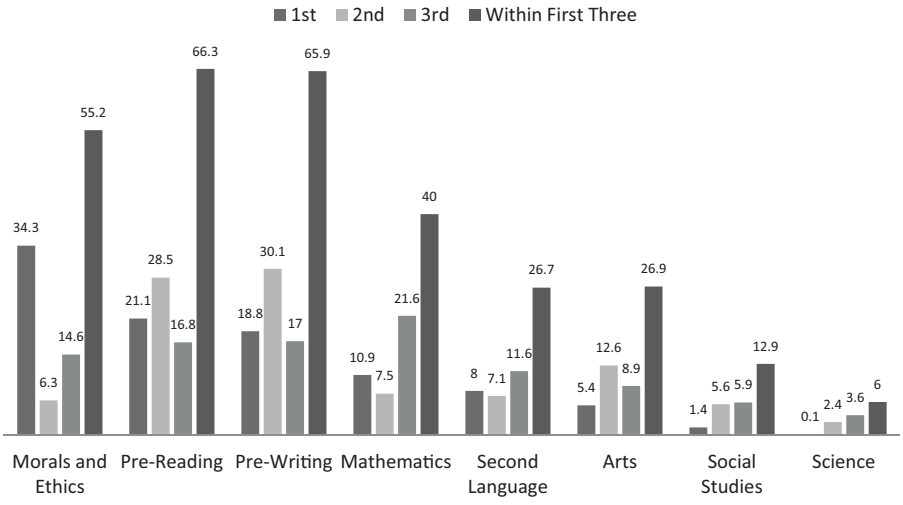

Fig. 2. Percentages for parents' top three rankings.

Only one parent ranked science as the most important academic content area and the percentage of parents who ranked science within their first three choices was merely 6%. Following science, social studies was the second least preferred area. A sizeable number of parents (950 participants, 65.2%) ranked social studies within their last three choices, and only 12.9% of the parents ranked social studies within their first three choices. More than a quarter of the participants ranked arts (26.9%) and second language (26.7%) within their first three choices.

3.2. Comparing the Top and the Bottom Science Rankers

Parents who ranked science within their top three and bottom three choices were compared based on their child's gender, age, and socioeconomic status (a composite variable that includes information about parents' income, level of education, and the number of children in the household) using the Chi-square test. Results demonstrated that the number of parents of boys who ranked science as a top priority was significantly higher than the number of parents of girls ($\chi^2(1, N = 1085) = 3.83$, $p = 0.05$, $\phi = 0.06$). Parents of older children were more likely to rank science within their bottom three choices ($\chi^2(2, N = 1085) = 8.52$, $p = 0.014$, $\phi = 0.09$). Also, parents with a high-SES level were more likely to rank science as a top priority ($\chi^2(2, N = 1085) = 16.07$, $p < 0.001$, $\phi = 0.12$).

3.3. Two-step cluster analysis

3.3.1. Cross validation

The data set was randomly split into two halves each containing 728 cases. Two-step cluster analyses were performed on each half. Then, the viability of a similar result was examined in the full sample. The Mann–Whitney *U* test indicated no significant differences between the subsets on cluster variables (*ps* > .01).

Cluster membership information obtained from the two-step cluster analysis was used as a dependent variable in the discriminant analysis to obtain discriminant function coefficients associated with the independent variables. Then, these coefficients were used to classify cases in the second data set. Two-step cluster analysis was performed for the second data set and resulting cluster membership information was compared to the classification information created by the discriminant function coefficients. Results demonstrated that 81% of the cases were correctly classified, which is higher than the percentage (76%) suggested by the Maximum Chance Criterion. Two-step cluster analyses on the two subsets and the full sample resulted in the same number and highly similar cluster types emerging. These results suggest that the cluster solutions across the samples were highly stable. Therefore, the results were reported for the full sample.

3.3.2. Three clusters

The two-step cluster analysis identified two distinct clusters of parents plus an outlier cluster. Variable importance values (ranging from 0 to 1) demonstrated that pre-writing (1.0), pre-reading (0.68), and moral and ethics (0.6) were the most important variables in defining memberships to cluster 1 and cluster 2 while science was the least important variable (0.13). Variable importance values suggest that most parents had similar science rankings (low) and parents do not deviate in their priorities for science. In other words, parents' science rankings were not useful in determining whether they are a member of the first or the second cluster.

The majority of the parents were in the first cluster. The first cluster included parents who tend to prioritize traditional academic content areas including reading, writing, and mathematics. The second cluster included parents who decisively prefer the inclusion of morals and ethics and arts in the early childhood curriculum. The last cluster consisted of parents who are identified as outliers by the two-step cluster analysis. Parents in this cluster tend to prefer teaching of science and mathematics to their youngster in the early childhood classrooms. A detailed description of the cluster profiles is provided below.

3.3.3. Cluster 1 (Three R's)

The first cluster included 736 (50.5%) participants. Pre-reading, pre-writing, and mathematics were highly rated by parents in this cluster. Over 90% of the parents who ranked pre-writing as the first (90.1%) or the second (94.1%) most important academic content areas were in this cluster. There were a total of 959 participants in the sample who ranked pre-writing within their first three choices and 727 of them (76%) were members of this cluster. Almost 99% of the cluster members ranked pre-writing within their first three choices.

Over 93% of the parents who ranked pre-reading as the first curricular choice and 74% of the parents who ranked pre-reading as the second most important domain were in this cluster. There were 966 participants in the dataset who ranked pre-reading within their first three choices and 728 of them (75.4%) were the member of this cluster. Like the pre-writing, almost 99% of the cluster members ranked pre-reading within their first three choices.

Mathematics was another important academic content area for the members of this cluster. Exactly 39% of the parents who ranked mathematics as their first choice, 14.7% of the parents who ranked mathematics as their second choice, and 76.4% the parents who ranked mathematics as their third choice were in this cluster. There were 582 participants in the sample who ranked mathematics within their first three choices and 318 of them (54.6%) were the member of this cluster. Over 43% of the cluster members ranked mathematics within their first three choices.

None of the participants in this cluster ranked science within their first two choices and only six participants ranked science as the third most important topic. There were 88 participants in the sample who ranked science within their first three choices and only six of them (6.4%) were the members of this cluster. More than half of the parents in this cluster (473) ranked science within their last three choices.

3.3.4. Cluster 2 (morals and ethics and arts)

The second cluster included 415 (28.5%) parents. Morals and ethics and arts were highly rated academic content areas by the parents in this cluster. Almost 81% of the parents in this cluster ranked ethics as their first choice and 92.6% of the cluster members ranked morals and ethics within their first three choices. There were 500 participants in the sample who ranked ethics as their first choice and 335 of them (67%) were in this cluster. Likewise, there were 804 participants in the sample who ranked ethics within their first three choices and 384 of them (48%) were the member of this cluster.

More than half the cluster members (52.8%) ranked arts within their first three choices. There were 392 parents who ranked arts within their first three choices in the sample and 219 of them (55.9%) were in this cluster. A total of 184 parents ranked arts as their second choice in the sample and 149 (81%) of them were in this cluster. None of the parents in this cluster ranked science as their first choice and only five participants (1.2%) ranked science as their second or third most important academic content areas. The majority of the parents (92%) in this cluster ranked science within their last three choices.

3.3.5. Cluster 3 (science and mathematics)

There were 305 (21%) parents in this cluster. Science and mathematics appeared to be the most important academic content areas for the parents in this cluster. A total of 88 parents ranked science within their first three choices in the sample and 77 of them (87.5%)

were in this cluster. In other words, the parent who ranked science as the first and 97.1% who ranked the second, and 80.8% who ranked the third most important academic content area were in this cluster. A quarter of the cluster members ranked science within their first three choices.

The results were similar for the domain of mathematics. Over 55% of the parents who ranked mathematics as the first and 51.4% who ranked it as the second most important area in the sample were in this cluster. More than half of the parents (59.7%) in this cluster ranked mathematics within their first three choices.

Less than one fourth of the parents in this cluster ranked pre-reading and pre-writing within their first three choices. Only 17.1% of the parents who ranked moral and ethics within their first three choices in the sample were in this cluster.

3.4. Comparison of cluster priorities

Differences in the percentages of preferred content areas across the three clusters were compared using the Chi-square test. The clusters were compared based on their members' priorities for pre-reading, pre-writing, mathematics, science, moral and ethics, and arts, which emerged as major academic content areas in defining cluster membership. The results demonstrated that the number of parents who ranked pre-reading as a top priority was significantly higher in the first cluster (Three R's) than the number of parents in the second (Morals and Ethics and Arts) ($\chi^2(1, N = 1151) = 539.71$, $p < 0.01$, $\phi = 0.68$) and the third cluster (Science and Mathematics) ($\chi^2(1, N = 1041) = 675.43$, $p < 0.01$, $\phi = 0.81$). The number of parents who ranked pre-reading as a top priority was also significantly higher in the second cluster than the number of parents in the third cluster ($\chi^2(1, N = 720) = 17.14$, $p < 0.01$, $\phi = 0.15$). Likewise, the number of parents who ranked pre-writing as a top priority was significantly higher in the first cluster than the number of parents in the second ($\chi^2(1, N = 1151) = 507.24$, $p < 0.01$, $\phi = 0.66$) and the third cluster ($\chi^2(1, N = 1041) = 735.64$, $p < 0.01$, $\phi = 0.84$). The number of parents who ranked pre-writing as a top priority was also significantly higher in the second cluster than the number of parents in the third cluster ($\chi^2(1, N = 720) = 40.18$, $p < 0.01$, $\phi = 0.24$).

On the other hand, the number of parents who ranked mathematics as a top priority was significantly higher in the third cluster than the number of parents in the first ($\chi^2(1, N = 1041) = 27.29$, $p < 0.01$, $\phi = 0.16$) and the second cluster ($\chi^2(1, N = 720) = 137.74$, $p < 0.01$, $\phi = 0.44$). The number of parents who ranked mathematics as a top priority was also significantly higher in the first cluster than the number of parents in the second cluster ($\chi^2(1, N = 1151) = 70.07$, $p < 0.01$, $\phi = 0.25$). Likewise, the number of parents who ranked science as a top priority was significantly higher in the third cluster than the number of parents in the first ($\chi^2(1, N = 1041) = 175.41$, $p < 0.01$, $\phi = 0.41$) and the second cluster ($\chi^2(1, N = 720) = 100.68$, $p < 0.01$, $\phi = 0.37$). However, the difference between the first and the second cluster was not statistically significant ($\chi^2(1, N = 1151) = 0.43$, $p = 0.51$, $\phi = 0.02$).

The number of parents who ranked morals and ethics as a top priority was significantly higher in the second cluster than the number of parents in the first ($\chi^2(1, N = 1151) = 318.48$, $p < 0.01$, $\phi = 0.53$) and the third cluster ($\chi^2(1, N = 720) = 199.26$, $p < 0.01$, $\phi = 0.53$). However, the difference between the first and the third cluster was not statistically significant ($\chi^2(1, N = 1041) = 3.75$, $p = 0.053$, $\phi = 0.06$). Also, the number of parents who ranked arts as a top priority was significantly higher in the second cluster than the number of parents in the first ($\chi^2(1, N = 1151) = 352.74$, $p < 0.01$, $\phi = 0.55$) and the third cluster ($\chi^2(1, N = 720) = 4.34$, $p = 0.03$, $\phi = 0.08$). The number of parents who ranked arts as a top priority was also significantly higher in the third cluster than the number of parents in the first cluster ($\chi^2(1, N = 1041) = 249.32$, $p < 0.01$, $\phi = 0.49$). Collectively, the results of the chi square analyses align well with the results of the cluster analysis and these results suggest that clusters contain homogeneous groups of parents with similar priorities for academic content areas and parental priorities differ significantly across the three clusters.

3.5. Parents' socio-demographic characteristics and cluster membership

In order to explore the relationship between cluster membership and parents' socio-demographic characteristics, a series of analysis of variance with Bonferroni correction ($\alpha = 0.0063$) was conducted. The results demonstrated that parents in three clusters do not differ in their priorities based on the number of children they have ($F(2, 1453) = 0.91$, $p = 0.40$), whether they have a boy or a girl ($F(2, 1453) = 0.78$, $p = 0.46$), and whether they are mother or father of the child ($F(2, 1453) = 2.49$, $p = 0.08$).

However, there was a statistically significant difference in the following socio-demographic characteristics between the parents in three clusters: parents' level of education ($F(2, 1453) = 64.68$, $p < 0.001$, $\eta^2 = 0.01$), child's age ($F(2, 1453) = 54.32$, $p < 0.001$, $\eta^2 = 0.07$), parents' income ($F(2, 1453) = 48.65$, $p < 0.001$, $\eta^2 = 0.06$), whether parents have an older child with previous pre-K experiences ($F(2, 1453) = 5.57$, $p = 0.004$, $\eta^2 = 0.01$), and whether parents reside outside of the provincial capital ($F(2, 1453) = 9.76$, $p < 0.001$, $\eta^2 = 0.01$).

Post hoc comparisons using LSD tests indicated that parents in the first cluster (Three R's) tend to have a lower educational level and income, have an older child, and live in rural districts (outside of provincial capital) than the parents in the second (Ethics and Arts) and the third clusters (Science and Mathematics) ($ps < 0.001$). Also, significantly less parents with a child with previous pre-K experiences were in the second cluster compared to the first ($p < 0.001$) and the third cluster ($p < 0.043$).

4. Discussion

The findings of the present study indicated that the number of parents who prioritize science over other academic content areas for their children in pre-K classrooms is quite low. While the majority of the parents (68.4%) ranked science within their last three choices, only six percent of the parents ranked science within their first three choices. Science appeared not to be a popular topic or a high priority for many parents, and few parents preferred their children to learn science in the early childhood classrooms.

Indeed, parents who ranked science highly deviated from the whole sample and almost all of these parents were identified as participants with an unusual preference pattern, which formed the science and mathematics cluster. The parents in the science and mathematics cluster were also different from the parents in the other clusters with regard to demographic variables. These parents were more likely to have a higher educational level and income, live in an urban district, and have a younger child in comparison to the parents in the first cluster (Three R's) and they were more likely to have a child with previous pre-K experiences than parents in the second cluster (Ethics and Arts). A comparison of parents who ranked science within their first and last three choices also demonstrated similar findings. Parents' of boys and younger children and parents with a high-SES level were more likely to rank science within their first three choices.

Several factors might be responsible for the reason most parents ranked science lower in this study. Studies suggest that parental beliefs regarding their children's competence are likely to influence the learning opportunities parents offer to their children (Dunton, McDevitt, & Hess, 1988; Hess, Holloway, Dickson, & Price,

1984; Jacobs & Bleeker, 2004; Miller, 1995). Like many early childhood teachers (Saçkes, in press), most parents of pre-K children might believe that their children are incapable of learning science concepts and skills, and therefore, perceive learning and teaching science in pre-K classrooms as a difficult task for their children or they believe teaching science to young children is developmentally inappropriate.

Parents' of boys were more likely to include science within their first three choices than the parents' of girls. This finding is congruent with previous studies on gender differences in parental expectations regarding academic content areas (Eccles, Jacobs, & Harold, 1990; Jacobs & Eccles, 1992). For example, parents expect boys to perform better in mathematics and science than girls (Herbert & Stipek, 2005; Tenenbaum et al., 2005). Thus, parents are more likely to offer learning opportunities and provide toys and materials that support the development of scientific and mathematical thinking skills in boys (Alexander et al., 2012; Freeman, 2007; Simpkins, Davis-Kean, & Eccles, 2005; Tracy, 1987). Even though there is no empirical evidence indicating that boys have an innate potential to perform better in science (Spelke, 2005), boys are perceived by their parents as being more competent and eager to learn science (Andre, Whigham, Hendrickson, & Chambers, 1999). Starting from the early elementary grades, boys tend to rate their science ability higher and report higher motivation to learn science than do girls (Andre et al., 1999; Breakwell, 1992; Kahle & Lakes, 1983; Patrick et al., 2009; Simpkins, Davis-Kean, & Eccles, 2006). Although studies have demonstrated that the science achievement gap related to gender is narrowing, the perceptional and motivational differences between boys and girls regarding their learning of science remains stable (Alexander et al., 2012; Baram-Tsabari & Yarden, 2010). Parental beliefs regarding the importance and appropriateness of learning science for their children are likely to result in boys and girls having differential access and exposure to science learning opportunities at home and in early childhood classrooms. While this early socialization might support the development of motivational beliefs that facilitate the learning of science in boys, it might be disadvantageous for girls. Early parental support might explain why the difference in science achievement between girls and boys becomes more prominent as they move into upper grades and why females are underrepresented in STEM-related careers.

In the present study, parents with high-SES levels were more likely to rate science as a higher priority than the parents with low-SES levels. Parents with high-SES appear to be more supportive of learning science in the early years. This might be due to high-SES parents having necessary economical and cognitive resources to support children's learning of science (Bradley & Corwyn, 2002; Mantzicopoulos et al., 2013; Zady & Portes, 2001). Alternatively, high-SES parents might believe that their children are competent in basic academic content areas typically targeted in early years, such as literacy. Hence, they prefer their children to excel in other content areas like science. Although parents with low-SES value academic learning in general, they might not have the resources to support their children's learning of science (Zady & Portes, 2001), thus, they do not prioritize science over other academic areas. Moreover, low-SES parents tend to have negative experiences in learning science and they might be intimidated when they need to help their children in science-related learning tasks (Mantzicopoulos et al., 2013; Zady & Portes, 2001). Parents own experiences with learning science might influence their preferences for science education in pre-K curricula. Parents with a positive attitude toward learning science and parents who perceive science as fun might be more likely to support their children's learning of science (Dierking & Falk, 1994; Ferry, Fouad, & Smith, 2000; George & Kaplan, 1998). High-SES parents and parents with a science-related education and careers may have positive experience with learning science and perceive learning science as a prerequisite for success in academic and social life, which might explain the high-SES parents' tendency to rate science as a higher priority than the low-SES parents in the current study.

Children's emergent science skills usually are not the target of instructional practices in typical early childhood classrooms (Saçkes, in press; Saçkes et al., 2011; Tu, 2006; Varol, 2013). Several factors, such as limited science and pedagogical content knowledge, the pressure to teach other content areas, the lack of science-related materials, and low self-efficacy for teaching science have been identified as reasons why teachers of young children devote less time to teaching science in their classrooms (Early et al., 2010; Garbett, 2003; Greenfield et al., 2009; Kallery & Psillos, 2001; Maier et al., 2013; Nayfeld et al., 2011). The findings of the present study suggest that parental priorities might be another major factor that contributes the limited visibility of science learning experiences in the early years. For more than two-thirds of the parents, science was the least preferred academic content area, whereas only six percent of the parents in this study prioritized providing science learning experiences to pre-K children. Unlike literacy and mathematics, many parents do not expect science to be a part of ordinary pre-K classrooms. The findings of the current study demonstrated that parental preferences align well with the early childhood teachers' tendency to teach less science (Greenfield et al., 2009; Nayfeld et al., 2011; Saçkes et al., 2011; Varol, 2013).

The present study focused on parental priorities for science learning in pre-K classrooms by inviting parents to rank eight academic content areas. Future investigations should gather data about the rationale that guides parents' rankings of academic content areas. More specifically, future studies could investigate the reasons parents prefer (or do not prefer) that their children learn science during the early years. In-depth interviews with the parents who ranked science within their top and bottom three choices regarding the reasons that motivate their preferences would help us better understand the factors that contribute to the limited visibility of science in early childhood classrooms. Parental priorities and preferences might be precursors to their educational practices at home. Future studies should also investigate the relationship between the quality and quantity of informal science learning experiences provided by parents and their priorities for science education in early childhood classrooms.

So far, a considerable amount of literature has been produced on parental priorities for early childhood curricula. However, the literature to date has tended to focus on parental priorities for developmental areas and the traditional academic content areas and skills (Dockett & Perry, 2004; Ebbeck, 1995; Kernan & Hayes, 1999; Knudsen-Lindauer & Harris, 1989; Saçkes, 2013). Parents' beliefs about and their expectations and priorities for science education in the early years have been largely neglected. The current study provides preliminary data on parental views on the place for science education within early childhood classrooms. More research studies are needed to understand how parental preferences, beliefs, and attitudes influence science learning opportunities provided to children and children's learning of science during the early years. Parents' beliefs about and attitudes toward science are likely to influence their children's attitude toward learning science and their motivation to later pursue science-related careers (Chen, 2001; Dierking & Falk, 1994; Ferry et al., 2000). Therefore, investigating parental beliefs about learning science in early childhood classrooms might be a key to understanding gender and socioeconomic disparities in science achievement in late elementary grades and beyond.

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