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Young children’s perceptions of scientists: a preliminary study

Mehmet Buldu*

University of Maine at Farmington, USA

Background
Since the 1950s, there has been a growing body of research dealing with perceptions children have of scientists. Typically, research studies in this area have utilized children’s drawings in an effort to discern what those perceptions are. Studies assessing perceptions children have of scientists have shown that children have stereotypical images of scientists. Although there is no direct evidence to demonstrate the link between children’s images of science and scientists with their career choice, several researchers (including this researcher) have assumed that children’s attitudes towards science are greatly influenced by their perceptions of science and scientists.

Purpose
This study aimed to find out if there was a difference in the way 5- to 8-year-old children drew scientists, taking account of age, gender and socio-economic status.

Sample
For this study a convenience sample of 30 young children was used. Participants included young children between the ages of 5 and 8 years from a public elementary school in Ankara, the capital city of Turkey. Although the sample of the study was obtained from one school in a metropolitan area, children involved in this preliminary study were from very different socio-economic backgrounds. As the sample size is very small for making comparisons, it was intended to have a similar number of children from different age groups and socio-economic backgrounds and both genders.

Design and methods
The researcher worked individually with each child who participated in this study in an interview setting. Although each child was asked a set of standard questions, and given a standard set of directions, each interview session was informal enough to allow the researcher to gain additional information about children’s drawings and to clarify any of their responses. During the interview sessions, children’s responses were noted by the researcher. Before the children were asked to draw their picture of a scientist, they were offered a set of coloured pencils or crayons and told to feel free to colour their drawing or any parts of it they would like to accentuate. At the end of the interview and drawing sessions, the researcher went through all the drawings and notes to get a ‘feel’ for and ascertain what was being said, identifying key themes in each drawing.

Results
The most common scientist type drawn in this study was the stereotypical scientist type: someone who conducts research, or someone who tries to invent a new material. But unlike previous studies, around 35% of the scientist figures drawn ($n=15$) were of the social scientist type. Stereotypical images drawn by the current study participants included symbols of research, such as scientific instruments and laboratory equipment of all kinds, and symbols of knowledge, principally books.

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and cabinets, technology and the products of science. An interesting finding of this study was that perceptions of young children differed due to their age. Children at the age of 8 years drew non-stereotypical scientist images, and they drew more detail than did their younger peers. When children were compared in terms of their gender, no significant differences were observed between girls and boys. But on the other hand, none of the boys drew female scientists, and five out of 30 children who were girls drew female scientists. While children of parents with lower socio-economic status drew more stereotypical scientist images, children of parents with higher economic status drew different images of scientists, a result which showed us that the scientist perceptions of young children differ with socio-economic status.

Conclusions

Emergent from this research has been a non-stereotypical perception of scientists, and some evidence exists that such a non-stereotypical perception differs due to age and socio-economic status. While these images may seem amusing, they also provide a reflection of the image that children have about what a scientist looks like. These images may have a powerful impact on present functioning and future plans of young children.

Keywords: Young children; Science; Scientists; Perceptions; Age; Gender; Socio-economic status

Introduction

Since the 1950s, beginning with the pioneering work of Margaret Mead (Mead & Metraux, 1957), there has been a growing body of research dealing with perceptions children have of scientists (Finson, 2002). Typically, the research studies in this area have utilized children’s drawings in an effort to discern what those perceptions are. Researchers who have studied children’s perceptions of scientists found pervasive, but questionable, preconceived ideas of scientists among all age levels of children (Barman et al., 1997). (See Figures 1 – 4.)

Studies assessing perceptions children have of scientists (Krause, 1977; Chambers, 1983; Schibeci & Sorenson, 1983; Fort & Varney, 1989; Finson et al., 1995; Huber &
Burton, 1995) have shown that children have a stereotypical image of scientists. Children in these studies generally perceive scientists as males with glasses, beards and strange hair, and wearing white lab coats: individuals who work in the

Figure 2. Social scientist images of scientists drawn by a 7-year-old girl

Figure 3. Non-stereotypical features (scientists observing, studying and searching) drawn by an 8-year-old boy

Burton, 1995) have shown that children have a stereotypical image of scientists. Children in these studies generally perceive scientists as males with glasses, beards and strange hair, and wearing white lab coats: individuals who work in the
laboratories, generally messing about with chemicals or constantly scribbling notes in
lab books. What does this say to us about the common perceptions of children when
they perceive scientists?

Perceptions here can be defined as impressions; and first impressions have been
claimed to last forever (Finson & Beaver, 1995). Children generally form their first
impressions at an early stage of their development and these impressions are most
likely formed at school. In teaching science to young children, teachers make an
impression on children: an impression about the teacher, about the science that they
are teaching and about the scientists. If and how these impressions affect young
children’s attitudes and learning remain unresolved questions. These impressions are
most likely to affect children’s attitudes and learning, and such ideas have been
supported by the work of Finson and Beaver (1995) and Krajkovich and Smith
(1982). If teachers of young children are to truly impact children’s perceptions of
scientists in a positive manner, and thus increase the numbers of children interested
in studying science and maybe even those who are interested in science-related
careers, then further study of children’s perceptions is needed (Finson & Beaver,
1995). Although there is no direct evidence to demonstrate the link between
children’s images of science and scientists with their career choice, several researchers
(Kahle, 1988; Boylan et al., 1992; Sjoberg, 1993), and including this researcher, have
assumed that children’s attitudes towards science are greatly influenced by their
perceptions of scientists. Thus finding out what particular views young children hold
might be a first step towards a clearer understanding of the impact of impressions on
young children.

Figure 4. A female scientist drawn by an 8-year-old girl
Numerous studies (Mead & Metraux, 1957; Chambers, 1983; Kahle, 1989) have pointed out that children hold both positive and negative images of scientists regarding their appearance, work, personalities and influence on people in society. As these images of scientists form part of children’s worldview, it is expected that they will influence children’s learning of science (Head, 1985); thus it is important to learn about young children’s images of scientists.

Previous studies designed to elicit the characteristics of stereotypical images of scientists have resulted in the use of several instruments, with subjects ranging from elementary school children to postgraduate adults. What is missing in the research literature are studies conducted with younger children. This preliminary study for a larger investigation aimed to find out if there was a difference in the way 5- to 8-year-old children drew scientists, taking account of their age and gender and the socio-economic status of the children’s parents.

Research questions

Specifically, the researcher was guided in this study by the following questions: how do young children aged 5 to 8 years perceive scientists?; how do these images differ among children due to their age and the socio-economic status of their parents?; and what is the stereotypical image of scientists among young children?

Methodology

For this preliminary study, a convenience sample of 30 young children was used. Participants included children aged between 5 and 8 from a public elementary school in Ankara, the capital city of Turkey. Although the sample of the study was obtained from one school in a metropolitan area, children involved in this preliminary study were from very different socio-economic backgrounds. For this study, as the sample size was very small for making comparison, it was intended to have a similar number of children from different age groups and socio-economic backgrounds, and of both genders. See Table 1 for the distribution of the sample by age and gender.

The researcher worked individually with each child who participated in this study in an interview setting. Interviews were conducted in a place where the researcher and the children were comfortable and would not be distracted by noise or peers. During each interview, the researcher sat next to the children at a table and provided ample time for them to draw and respond to the researcher's questions. Although each child

<table>
<thead>
<tr>
<th></th>
<th>5-year-olds</th>
<th>6-year-olds</th>
<th>7-year-olds</th>
<th>8-year-olds</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Boys</td>
<td>4</td>
<td>3</td>
<td>4</td>
<td>4</td>
<td>15</td>
</tr>
<tr>
<td>Girls</td>
<td>4</td>
<td>4</td>
<td>3</td>
<td>4</td>
<td>15</td>
</tr>
<tr>
<td>Total</td>
<td>8</td>
<td>7</td>
<td>7</td>
<td>8</td>
<td>30</td>
</tr>
</tbody>
</table>
was asked a set of standard questions and given a set of standard directions, each interview session was informal enough to allow the researcher to gain additional information about children’s drawings and to clarify any of their responses. During the interviews, the following questions were asked: ‘Will you please draw a picture of a scientist doing science? When you are finished, will you please explain your drawing? What do the scientists do?’

During the interview sessions, children’s responses were noted by the researcher. Before the children were asked to draw their picture of a scientist, they were offered a set of coloured pencils or crayons and told to feel free to colour their drawing or any parts of it they would like to accentuate. At the end of the interview and drawing sessions, the researcher went through all of the drawings and notes to get a ‘feel’ of what was being said, identifying key themes in each drawing.

One of the premises in choosing the drawings in addition to interviewing was that children at these ages lack writing skills, and it is almost impossible for them to write about their perceptions of scientists. Thus the researcher chose drawing and interviewing methods to derive adequate information regarding perceptions children have of scientists.

**Analysis and interpretation**

Based on the framework provided by the questions and results of the interviews, the findings can be categorized into four main groups (presented in Table 2): scientist type; gender of the scientists; activities in which the scientists are involved; and features of the scientists. When sorting the data, the researcher first examined the similarities among the subjects’ drawings and responses, and then analysed the differences in general.

The first stage in analysing the children’s drawings was to record the number of scientists and the gender of the scientists, as well as the number of activities in which the scientists are involved, and features of the scientists drawn. Five out of 30 children who participated in this study drew nothing, but talked to the researcher; 15 drew only one scientist; and 10 drew two or more scientists and scientist features. A total of 42 scientists were drawn in this study. Table 3 illustrates the distribution of the number of scientists drawn by age group.

Then each group—scientist type, gender of the scientists, activities in which the scientists are involved and features of the scientists—was analysed to obtain the overall picture. The most common scientist type drawn in this study was the stereotypical scientist type: someone who conducts research and who tries to invent a new material. Around 65% of the scientist figures drawn \((n=27)\) were of this stereotypical type. But on the other hand, unlike the previous studies, around 35% of the scientist figures drawn \((n=15)\) were of the social scientist type. Children in the current study, for instance, drew scientists as journalists who type on a typewriter, together with novelists/poets, artists who paint and university professors who teach in class, rather than stereotypical images of scientists as drawn in previous studies.

Equipment used by the scientists drawn in this study also differed from the drawings in previous studies. Stereotypical images drawn by the current study...
Table 2. Scientist drawing profiles, by gender and age group

<table>
<thead>
<tr>
<th>Age</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>Gender</th>
<th>Girls</th>
<th>Boys</th>
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<td>Type</td>
<td>Scientist&lt;sup&gt;1&lt;/sup&gt;</td>
<td>5</td>
<td>5</td>
<td>8</td>
<td>9</td>
<td>9</td>
<td>18</td>
</tr>
<tr>
<td></td>
<td>Social scientist&lt;sup&gt;2&lt;/sup&gt;</td>
<td>–</td>
<td>1</td>
<td>5</td>
<td>9</td>
<td>9</td>
<td>6</td>
</tr>
<tr>
<td>Gender</td>
<td>Male scientist</td>
<td>5</td>
<td>6</td>
<td>11</td>
<td>15</td>
<td>13</td>
<td>24</td>
</tr>
<tr>
<td></td>
<td>Female scientist</td>
<td>–</td>
<td>–</td>
<td>2</td>
<td>3</td>
<td>5</td>
<td>–</td>
</tr>
<tr>
<td>Activity</td>
<td>Research</td>
<td>1</td>
<td>1</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>5</td>
</tr>
<tr>
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<td>Experiment</td>
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<td>2</td>
<td>2</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>Invention</td>
<td>1</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
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<td>1</td>
<td>2</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>Teaching</td>
<td>–</td>
<td>–</td>
<td>2</td>
<td>1</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>Writing</td>
<td>–</td>
<td>–</td>
<td>1</td>
<td>2</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>Repairing/manipulating</td>
<td>–</td>
<td>1</td>
<td>–</td>
<td>2</td>
<td>–</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>Art</td>
<td>–</td>
<td>–</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>–</td>
</tr>
<tr>
<td></td>
<td>Other&lt;sup&gt;3&lt;/sup&gt;</td>
<td>1</td>
<td>–</td>
<td>1</td>
<td>1</td>
<td>–</td>
<td>3</td>
</tr>
<tr>
<td>Features</td>
<td>Symbols of research&lt;sup&gt;4&lt;/sup&gt;</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>5</td>
<td>7</td>
</tr>
<tr>
<td></td>
<td>Knowledge symbols&lt;sup&gt;5&lt;/sup&gt;</td>
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<td>1</td>
<td>2</td>
<td>4</td>
<td>3</td>
<td>5</td>
</tr>
<tr>
<td></td>
<td>Technology&lt;sup&gt;6&lt;/sup&gt;</td>
<td>–</td>
<td>1</td>
<td>3</td>
<td>5</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td></td>
<td>Other features&lt;sup&gt;7&lt;/sup&gt;</td>
<td>1</td>
<td>1</td>
<td>5</td>
<td>6</td>
<td>6</td>
<td>7</td>
</tr>
</tbody>
</table>

Notes:
<sup>1</sup>Biologists, chemists, lab technicians, computer scientists, doctors, astronauts, etc.
<sup>2</sup>Journalists, novelists/poets, artists, professors, etc.
<sup>3</sup>Examining, reading, searching, etc.
<sup>4</sup>Laboratory material and equipment, including microscope, test-tubes, etc.; lab work in action, including experiments, working with chemicals.
<sup>5</sup>Books, bookshelves, cabinets, writing-boards, pencils.
<sup>6</sup>TV, antennae, computers, robots, rockets, etc.
<sup>7</sup>Animals, plants, rocks, moon/stars, binoculars, monsters, guns, paintings, typewriter, fire-extinguisher, etc.

Table 3. Number of children drawing scientists, by age group

<table>
<thead>
<tr>
<th>Age</th>
<th>One scientist</th>
<th>One or more scientists</th>
<th>No scientist</th>
</tr>
</thead>
<tbody>
<tr>
<td>5</td>
<td>5</td>
<td>–</td>
<td>3</td>
</tr>
<tr>
<td>6</td>
<td>4</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>7</td>
<td>3</td>
<td>4</td>
<td>–</td>
</tr>
<tr>
<td>8</td>
<td>3</td>
<td>5</td>
<td>–</td>
</tr>
<tr>
<td>Total</td>
<td>15</td>
<td>10</td>
<td>5</td>
</tr>
</tbody>
</table>

Note: A total of 42 scientists were drawn in this study.
participants included symbols of research, such as scientific instruments and laboratory equipment of all kinds, and symbols of knowledge, principally books, cabinets, technology and the products of science. These results echoed the findings of Chambers (1983), Chiang and Guo (1996) and Barman et al. (1997). But in the current study, non-stereotypical features such as monsters, paintings, typewriter and fire-extinguisher, were drawn as well.

What can be said about these first two findings is that the boundaries by which children differentiated scientists one from another was vague since very different definitions of scientists were provided by the children. For instance, Chambers (1983) reported that the key characteristics of the stereotypical image of scientists remained relatively stable from 1945 to 1975, and described seven essential characteristics as the basis for assessing the typical image in children’s drawings of scientists: lab coats, spectacles, facial hair; symbols of research, including scientific instruments and laboratory equipment of all kinds; and symbols of knowledge, including books and filing cabinets, technology, danger warnings, etc. (Chambers, 1983). Over 50% of children in the current study did not draw for the most part those stereotypical images, but drew ‘non-stereotypical’ images in general.

An interesting finding of this study was that, on analysing all of the drawings, it was found by the researcher that perceptions of young children differed with the age of the children (see Table 2). Children at the age of 8 years drew non-stereotypical scientist images, and drew more detail than did younger children (see Figures 2 and 3). This might indeed be due to intellectual level and the children’s educational experience. This result was dissimilar to that of Schibeci and Sorenson (1983), whose findings in their study were similar to what Chambers (1983) had reported. In their study with elementary level children, Schibeci and Sorenson found that as children progressed through successively higher grade levels, their images of scientists became more and more stereotypical. Chambers (1983) reported that the essential characteristics of the stereotypical image of scientists remained relatively stable among children.

When children were compared in terms of gender, no significant differences were observed between girls and boys. But none of the boys drew female scientists, and five out of 30 children, all of whom were girls, drew female scientists. See Figure 4 for an example of a female scientist drawn by an 8-year-old girl. This trend in studies that represented male scientists greatly outnumbering female scientists was echoed in previous studies (Krause, 1977; Chambers, 1983; Schibeci & Sorenson, 1983; Fort & Varney, 1989; Flick, 1990; Finson et al., 1995; Huber & Burton, 1995). These depictions seem to mirror the under-representation of females in science careers in the society (Monhardt, 2003).

While children of parents with lower socio-economic status drew more stereotypical scientist images, children of parents with higher economic status drew different images of scientists. This result showed that scientist images of young children differ due to socio-economic status. Children who drew non-stereotypical images of scientists came from well-educated and higher socio-economic level families. Although the sample is too small to extrapolate, it can be inferred from this result that children of well-educated families are more inclined to hold non-stereotypical images of scientists, and that these children are exposed to different
educational experiences and have different perceptions than the children of less educated, low socio-economic level families. In order to close a possible gap that may exist between the educational experiences of children of different socio-economic status, education is crucial. Educational experiences are vital in improving the socio-economic situation of young children and their social integration, as well as diminishing their exclusion. If teachers and schools cannot find ways to ensure that all children have equal opportunities and are able to participate fully in society, then the result is serious.

The link between children’s perceptions of scientists and their interest in science-related careers was, in some part, demonstrated throughout this study. When drawing their image of scientists, eight children pointed out that in the future they wanted to be the scientist they had drawn. When asked why they wished to be this particular scientist, the common response from the children was that they were drawing the person they saw as a model, or whom they admired and had affection for. These persons were either someone they knew in the family or in the community, or a character they had seen on TV. This result indeed may show that family members and people from the community, as well as characters on TV, may influence children’s perceptions of science and scientists and their interest in science-related careers.

A similar finding also reflected the relationship between children’s perceptions of scientists and their interest in science-related careers. In this study, several children stated that they did not wish to be a scientist, because scientists ‘never have fun’. Although the numbers of children who stated this were not many, the researcher believed this to be of significance in showing the relationship between the children’s perception of scientists and their attitudes towards science.

Another finding was that three 5-year-old children and two 6-year-old children responded to the researcher’s question; ‘Will you please draw a picture of a scientist doing science?, by replying that ‘My teacher did not teach it to me! So, I do not know how to draw a scientist.’ This result shows how young children are indeed affected by how they are taught: five out of 30 children who participated in the study could not draw anything, perhaps as a result of the teachers’ use of direct instruction methods (like many other teachers in Turkey). This touches on a long-standing curriculum debate within early childhood education as to whether earlier years teaching should follow a traditional academic model used generally with older children (i.e. large-group, teacher-directed formal instruction) or whether learning experiences for children who attend the early childhood programmes should be informal and consist largely of child-initiated activities (Banks, 2001). This study reveals, in some part, that teachers of young children in Turkey generally use the direct instruction method where children are dependent on didactic cues from the teacher.

The findings in this study also indicate that what children know about science and scientists, in general, comes from their out-of-school life. The flexible question asked to the children by the researcher after drawing revealed that the images children have generally derived from the mass media, especially from TV. For instance, one child who drew a chemist with an extraordinary hairstyle was asked how he knew that the scientists experimented with chemicals, and another child who drew a scientist killing birds and fish was asked where he had learnt that scientists may kill birds and fish.
The responses from these two children were the same: ‘I saw it on TV’. Another child, who drew a female scientist with a white lab coat using a microscope, was asked what the scientist in the picture was doing. The child’s response was very interesting:

She is investigating about dangerous worms. After she finds out what those worms are, she will produce medicine for people who got affected from those worms and will save the world from the bad people.

It may well be understood from this quote, that this particular child had got this notion from watching TV. Most of the children involved in the study were greatly influenced by the science they saw depicted on TV, and many of them used what they had seen in their portrayal of the scientists. Changing children’s perceptions about science and the scientist is a task that falls to the teachers and schools: while it may be difficult to counter the scientist images as portrayed in the mass media, what happens in schools also greatly influences what children believe about science and scientists (Monhardt, 2003).

**Implications**

Teachers at the early childhood level and at the elementary grades—perhaps more than at any other instructional level—play a vital role in creating children’s perceptions about science and scientists. This preliminary study showed that children aged between 5 and 8 years had vague perceptions of either who scientists are or what they do; and indeed some children at the same age did not have any perceptions of scientists at all. The results of this study provide useful information to those engaged in early childhood education. A clearer understanding of young children’s perceptions of scientists has implications for the teachers of young children. Once teachers know what perceptions children may possess, they can modify their teaching, perhaps, by including: visitors who represent science-related occupations, organizing field trips to see ‘science in action’, involving children with more hands-on science activities and bringing more science books to the classroom. These experiences should provide exposure to a variety of role models, including female scientists, scientists representing a larger array of cultures and scientists conducting research in both field and laboratory settings. Children at these ages need to be offered more concrete examples in school that will enable them to make connections between school science and what they do outside of school. Instead of children simply waiting for their teachers to instruct them as to what a scientist is or what he or she does, teachers should design experiences for children, to build more realistic and positive images of scientists and their work.

It is noteworthy that the mass media, especially TV, play an important role in the formation of young children’s images of scientists. The ‘strange’ scientist characters in cartoons or TV shows that introduce children to science may be doing more of destruction than formation. Reinforcing the man-in-a-lab-coat or ‘mad scientist’ stereotype could shrink not only children’s interest in science, but even the number and diversity of future scientists and scientific workplaces (Bradley, 2001). Certainly
this provides a valuable clue for further studies on the perceptions children hold of scientists, and for appropriate instructional support for teachers to help young children to construct less stereotypical images of the scientist.

In programmes for young children, video tapes or CDs featuring scientific expeditions and investigations present scientists in a real-life situation. Inviting women to talk with the class about how they learn and use science would offer prospects for children to broaden their ideas about scientists on a more personal level: building on these experiences, pointing out the scientific contributions made by females would further broaden children’s perspectives. Historical sequences developing our understanding about the way things work would help children gain an appreciation of the contributions and personalities of scientists as ‘real people’ (Barman et al., 1997).

This study has implications also for the schools and the community. It has been shown that not all children have the same educational experiences. Schools and communities must provide all children, including children of parents from very different socio-economic backgrounds, with the effective schooling, extra educational help and support systems they need to meet the educational standards demanded by the society. Teachers and schools should recognize that children come to school with diverse backgrounds and provide constructive educational experiences, including science-related experiences, which build on those backgrounds.

**Conclusion**

Emergent from the research has been what one may call a non-stereotypical perception of scientists, and some evidence exists that such a non-stereotypical perception differs due to the age of children as well as the socio-economic status of children’s parents. While these images may seem amusing, they also provide a reflection of the image that children have about what scientists look like. How children view the world is likely to change their destiny; the images have a powerful impact on present functioning and future plans of young children.

It is hoped that the findings of this preliminary study might initiate a dialogue among education professionals about what lesson may be drawn from this research, and what the next steps should be in terms of science-related practices with young children. This preliminary small-scale study provided rich data contributing to that growing body of literature examining children’s perceptions of science and scientists. However, the data were collected from only one school and it is therefore difficult to determine what effect teachers had on children’s perceptions. Scientist perceptions of young children remain to be investigated thoroughly, and further research is needed to make explicit the perceptions that young children hold.

**References**


