# Observing the effects of familiarity on puzzle completion time in preschool children

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BRIEF. Using puzzles to determine if the familiarity of the teacher impacts how long it takes for preschool students to complete the puzzles.

ABSTRACT. Familiarity plays a significant role in children's emotional and mental development. Children are heavily impacted by the people in their environments, and their teachers are an important factor in their development. It is important that teachers attempt to develop relationships and become familiar with their students in addition to taking quality care of them. There have been mixed results about whether familiarity has an impact on how well children learn. The time it took for eight preschool children to complete one easy and one hard puzzle in front of their primary teacher and a teacher they do not know was recorded. In addition to the time completed, age, type of puzzle, and any relevant behavioral notes were also noted. Using a two-way ANOVA that analyzed the effect of difficulty and familiarity, it was found that the children completed the easy and hard puzzles the fastest with their primary care teacher. This is useful for preschool teachers who are trying to find the best way to teach their students. It is also helpful for parents attempting to find the most suitable help for their kids who may be struggling in classes.

INTRODUCTION.

A child needs to have familiar peers and friends to interact with, especially during their early developmental stages. Being around other children helps them develop emotional skills like empathy and cooperation which can be beneficial to a child's learning [1]. Children tend to enjoy collaboration and interaction with individuals with whom they are familiar compared to those with whom they are unacquainted [2]. Children also tend to rely more on the information given to them by familiar television characters (e.g., Dora the Explorer) compared to unfamiliar characters. They are more likely to trust and endorse subjective opinions from familiar characters rather than similar opinions from characters they do not recognize [3].

Familiarity is also important for emotional development. For example, it is easier for toddlers to remember facial expressions belonging to people that they recognize [4]. This has important implications for childcare staff who spend a significant amount of time with toddlers during important developmental stages. Childcare staff who exhibit high-quality care and relationships with the children in their classroom encourage more eagerness to learn and help their social-learning development [5]. Becoming familiar and developing that high-quality relationship with their teacher helps children settle into new daycare environments and encourages more development for their social-emotional maturity. [5]. In toddlers (aged 18-24 months) there is a relationship between learning prowess and familiarity with the teacher if they are directly being taught by them [6].

This study aims to gather more information about the effects of familiarity on learning in toddlers in a daycare environment. In this study, preschool children were observed to determine whether the presence of their primary teacher, compared to an unfamiliar staff member, affects the time it takes for them to complete puzzles of varying difficulty. Additionally, there were childcare staff interviews conducted. While there have been studies on how the familiarity of peers influences social interactions and emotional behaviors in toddlers, the familiarity of the teacher and its effect on learning capabilities and information retention needs more attention [1][3]. Since children are more interactive with people they know, it is expected that they will complete the puzzle the fastest when doing both the easier and the harder puzzles with their primary daycare teacher [4] [7].

MATERIALS AND METHODS.

*Participants.*

A total of 8 pre-school children (4 boys and 4 girls, mean age= 2.875, range 2-3) completed a total of 4 puzzles, 2 in front of their primary school teacher and 2 in front of a teacher they had not previously met (floater). There were 3 data points missing for participant F4 due to shyness and 2 missing for M4 due to their absence. Before participating in the study, parental permission was obtained from parents of children in the observed classroom at Vanderbilt Child and Family Center daycare center, The Acorn School. Experimental procedures were approved by the School for Science and Math at Vanderbilt Institutional Review Board.

The primary teacher and the floater were interviewed via Zoom call, apart from class time. In the interview, both the primary teacher and floater were asked 3 questions about their teaching styles, and then the primary teacher was asked 6 questions about each of her students. Thematic analysis was performed on the answers from the interviews and 3 codes were analyzed from the answers. The thematic analysis was done based on the video, "Qualitative analysis of interview data: A step-by-step guide for coding/indexing" by Kent Löfgren. [8]. This thematic analysis uses coding and indexing to analyze qualitative data.

*Materials.*

There was a total of 6 different puzzles used (Fig.1). There were 4 different easy puzzles (F1, F2, F3, and F4) and 3 hard puzzles (F2, F5, and F6). F1-4 had 9 pieces each, and F5 and F6 had 12 each. The puzzles were already in the Tulip Gove classroom at the Vanderbilt Child and Family Center when the experiment was conducted.

*Procedure.*

The students first completed an easy puzzle in the presence of their primary daycare teacher. Students were timed and were observed for any


**Figure 1.** The 6 puzzles used by the children in the experiment.

behavioral notes. The difficulty of the puzzle was determined by the primary teacher based on the student's individual ability. The teacher decided which puzzles each child should complete based on their proficiency in her class. Most of the children did a 9-piece puzzle for their easy puzzle and a 12-piece puzzle for their hard puzzle, except child M2, who completed a 9-piece puzzle for both easy and hard. The teacher decided that based on M2's individual ability, a harder 9-piece puzzle would constitute as their hard difficulty puzzle instead of a 12-piece puzzle. Puzzles F1, F2, and F3 were all puzzles that were already in the classroom and F4, F5, and F6 were new. Since puzzles F1-F3 they were familiar to the students, they were used as their easy puzzles. After the easy puzzle, the children then completed a hard puzzle in front of their primary teachers and were timed and observed for behavioral notes. Three days later, this 2-puzzle process was then repeated with another staff member that is not a permanent part of the child's classroom staff (floater). The children completed the same two easy and hard puzzles that they did with their primary teacher. The children were allowed to accept assistance from the teacher if necessary. If the children asked for help, that interaction was recorded in the behavioral notes. The trials were completed on two separate days, where on the first day, the children did the puzzles with their primary teacher, and on the second day, they completed the puzzles with the floaters.

*Data analysis.*

In order to analyze the effect of familiarity (floater or primary teacher) on the time completed, we used JMP (John's Macintosh Project) to conduct an Analysis of Variance (ANOVA) [9]. Another ANOVA was conducted to see how the difficulty of the puzzle (easy or hard) affected the time completed. To analyze the effects of familiarity and difficulty on time, we ran a two-way ANOVA with familiarity and difficulty as the independent variables and time as the dependent variable. There was also a thematic analysis done on the interview results to see the interactions between the two teacher's answers.

*Data and participant safety.*

Names were removed for data collection and were replaced with a participant identification number. During the Zoom interview, the use of video was optional but not required. There were no video recordings of the interview, but the transcript feature in Zoom was enabled to record a text-only transcript of the conversation.

RESULTS.

Research suggests that children are more collaborative and work better with people they know, therefore it was expected that they would complete their puzzles the fastest when doing the easier puzzle with their primary teacher. Table 1 shows the time that it took for each child to complete their easy and hard puzzles in the presence of the primary teacher and the floater. In a comparison testing the difference in completion time and familiarity (primary teacher, floater) there was no significant difference observed. The ANOVA revealed no significant difference between the times completed for the primary teacher compared to the floater ($F(1,26)= 1.0247$, $p=0.3$).

There was a significant difference in completion time for easy and hard puzzles ($F(1,26)= 14.8665$, $p=0.0007$). The students completed the easy puzzles much quicker than the harder ones. A two-way ANOVA was done to see the effect of familiarity and difficulty on the time it took for them to complete the puzzles. We found a significant difference in completion time for familiarity (primary teacher, floater) and difficulty (easy, hard) ($F(2,26)= 8.77$, $p= 0.0014$). Figure 2 shows this significance and how much longer it took the students to complete the puzzles with the floater. Students completed the easy and hard puzzles quicker with the primary teacher. The fastest times were when the students were completing their easy puzzles with their primary teacher.

**Table 1.** Each student's completion time based on the condition.

| Condition | | Time completed (s) | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | M1 | F1 | M2 | F2 | M3 | M4 | F3 | F4 |
| **Teacher** | | | | | | | | | |
| | Easy | 57.6 | 64 | 72 | 96 | 97 | 65 | 59.4 | * |
| | Hard | 210 | 126 | 426 | 387 | 156 | 184 | 224 | * |
| **Floater** | | | | | | | | | |
| | Easy | 71 | 70 | 43 | 95 | 98 | * | 79 | 96 |
| | Hard | 304 | 200 | 1008 | 643 | 128 | * | 251 | * |

* ¾ of the data points for F4 were not recorded due to shyness and 2/4 of the data points for M4 were empty due to absence.

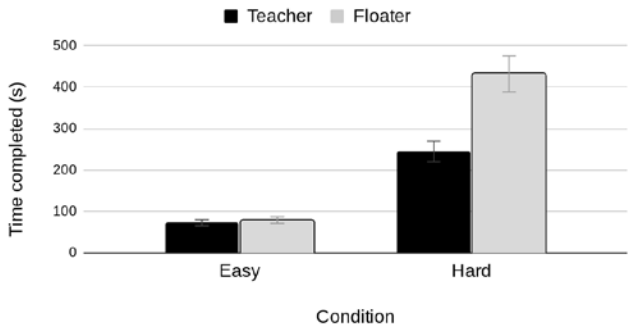


**Figure 2.** Graph of the Average time completed in seconds, based on difficulty (easy, hard) and familiarity (teacher, floater). Students were timed for the easy and hard puzzles they completed in front of their teacher and the floater.

*Interviews.*

There was an interview conducted to assess the similarities of the teaching styles of the primary teacher and the floater teacher. The primary teacher and floater were asked questions about their teaching styles and questions about the children's proficiency in class (see supplemental 1). There were some questions pulled from the Ages and Stages Questionnaire Third Edition (ASQ-3) 24 months and ASQ-3 36 months. The ASQ questionnaire provides screening for the development and social emotional learning of children from birth to age 6. It's used to observe developmental progress and catch any delays. [10] The primary care teacher was asked questions about each of the eight students' proficiency in class. They were asked the following question about performance in class, "Does this child tend to score above average, average, or below average on formal assessments if you have any?" and the results showed that 50% of the children perform average in the class, 37.5% of the children perform above average, and 12.5% perform below average. The primary care teacher found that it was easier to teach all eight children at the beginning of the school year compared to the end. The primary care teacher was asked 6 questions from the ASQ so that more can be learned about the student's development in practical tasks. The first ASQ-3 question was, "Does this child speak in sentences that are three to four words long?" and the results were that 75% of the children are able to speak in sentences that are 3-4 words long and 25% are not. Next, they were asked, "When you show the child a zipper going up and down and say, 'See this is going up and down' and then ask them to pull the zipper up, do they pull the zipper up?" and the results showed that 87.5% of the children are able to imitate an action shown by their teacher when told and 12.5% are not. All eight of the children were able to carry out a task when instructed by their teacher. Finally, when the primary teacher was asked, "Does this child know how to use me, I, and you correctly?" and the results showed that 87.5% of the children cannot use I, me, and you correctly while 12.5% of them can occasionally.

A thematic analysis was also conducted based on the interviews that were done with the teacher and the floater. In order to complete the analysis, the interview transcripts were read, and any relevant and heavily repeated words/concepts were noted. The relevant concepts

among the two interviews are separation into codes or themes. This analysis helped to see if there were any common ideas or differences in their teaching methods and the ways they form relationships with their students. It was found that they both have different approaches to teaching. In reviewing the transcripts, it was seen that the primary teacher is more interactive with the students and goes out of their way to meet the students and develop the relationship early on. Alternatively, the floater is more distant and does not intervene with the students unless necessary, but she still finds a way to form modest relationships with them. The transcripts were read to identify common themes. The three common themes that were found are: 1) Accessibility: making yourself available, helping the children when necessary, and letting the kids work and jump in if needed, 2) Emphasizing verbal communication: emphasizing the importance of communication and helping them learn the relevant verbiage and language, and 3) Dependability: consistently working with the children and making sure the students understand that the teachers are available when needed.

## DISCUSSION.

The aim of this study was to see how familiarity and puzzle difficulty affected the children's performance on a puzzle task. Most research pertaining to child learning emphasizes how important it is for teachers to form relationships with their students (5). The focus of this study was to examine whether students perform best in front of their primary teacher or a teacher they are unfamiliar with. The experiment observed preschool students completing two puzzles of varying difficulty with a teacher they know and a teacher they are unfamiliar with. We found that students were much faster when completing the harder puzzle with their primary teacher. This coincides with the hypothesis and shows that children tend to perform better when they are around teachers, they are familiar with. The results shows that familiarity and difficulty together had an impact on how long it took for each child to complete their puzzles. Although familiarity alone didn't have an impact on completion time, it was found that the children completed their hard puzzles much faster when in the presence of their primary teacher. Replicating this study with the addition of a parent or a sibling alongside the teacher and floater would add a deeper level of familiarity and could cause the results to vary more.

In the interviews, both the primary teacher and the floater were asked a series of 3 questions about the way they teach their children. For both of their answers, they both discussed introducing new skills and language to the children. The children that they teach are in a stage where they are learning to be more independent, so their teachers need to show them new things they should learn. Another common point between their answers was to be there and provide significant support for their students. This leads to a disconnect between their answers. J (the primary teacher) was much more present in the on-goings of the students and took time out to try and develop relationships with her future students. M (the floater) was a bit more in the background. She focused more on letting the kids handle situations by themselves before she jumped in, and she did not want to create any close relationships because she was not in the same class for long periods of time.

Based on the interviews, in order to develop a good relationship with their students, both teachers followed the same train of thought. They first made themselves someone reliable. The primary teacher introduces herself to her students beforehand and makes herself familiar to the child. The floater makes sure she is consistent and there for the children, but eventually gives them the space to grow without her assistance. The children are learning to be more independent, so the teachers help by demonstrating new actions and introducing new language and verbiage into the classroom. They teach the children how to interact with their peers and other teachers. After they introduce more verbal communication skills, the teachers fall back and let the children interact on their own. They make themselves available to the children and can jump in whenever they need that push or some assistance. This shows the process that the teachers typically use to develop relationships in the classroom. As the student becomes more familiar with the teacher, they find it easier to complete harder tasks. The interview represents how important it is for long-term teachers to develop relationships with their students. It's important to have support in the beginning when learning basic tasks and communication, but it's also important when they start building on those basic skills.

This study is relevant because it is important to study the relationship between the learning of a child and the familiarity of their teacher. The results of this study can help teachers and mentors who work directly with children. It is important to understand the best way a child learns. The results will also help us learn more about how children are impacted and potentially learn from those around them. As we uncover more information about child development and learning, it will help find the best way to teach students and help anyone struggling. Future studies should investigate how direct instruction from the teacher differentiates depending on the familiarity. There are not many studies on how hands-on learning is affected by familiarity. It should be noted that this study was done on a much smaller scale than most done in this field. In the future, this study should be replicated with more students.

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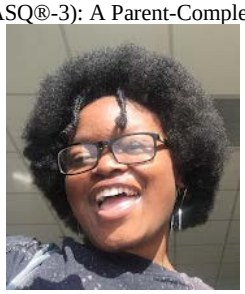

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