The impact of age, empathy, screen usage, and sensation seeking on children's cognition and social behavior

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Abstract

This research examines the relationship between empathy and the everyday behaviors and development of children. In order to test this, 116 students from Scotland and Ireland between the ages of 5 to 13 were given an empathy questionnaire, a sensation seeking questionnaire, a cognitive abilities task, and a behavioral observation was performed. Results showed that cognitive function, cognitive empathy, and intent to comfort increase with age. They also show that there is a negative correlation between intent to comfort and antisocial behaviors. When moderated by disinhibition, there is a positive correlation between empathy and prosocial behaviors. Additionally, screen usage is linked to better working memory. Empathy is linked to increased prosocial behavior and decreased antisocial behavior. Analysis of the test results showed that children develop an intent to comfort as they age and that intent to comfort is linked to reduced antisocial behavior.

Empathy shapes how children think, play, and interact with the world around them. Recognizing the impact of empathy on children's lives can help to explain their behaviors and development. This study aims to investigate the relationship between empathy and the everyday behaviors and development of children. This includes cognitive functioning, sensation seeking, social behaviors, and the impact of other factors such as screen usage on these measures. To investigate this, we conducted an empathy test, a sensation seeking test, a cognitive abilities test, and a behavioral observation of 116 Scottish and Irish school children between the ages of 5 and 13. We used these measures to determine several factors defined below.

Before defining the hypotheses, it is essential to define the terms: empathy, sensation seeking, prosocial and antisocial behaviors.

Empathy is used to describe an affective response resulting from understanding or feeling of someone else's emotions (Eisenberg, 2006). Empathy can be divided into three subtypes: affective empathy (feeling other people's emotions), cognitive empathy (understanding other people's feelings), and intent to comfort (Overgaauw, 2017).

Sensation seeking is the tendency to seek intense and new experiences. Someone high in sensation seeking is often willing to take risks in order to obtain these new experiences (Zuckerman, 1972).

Antisocial behavior consists of aggressive interactions and/or rule breaking. These behaviors tend to hurt others or disrupt societal norms (Klahr et al., 2012). Prosocial behavior is the opposite, it is a type of social interaction in which one person performs an action with the intention to help others (Wu & Hong, 2022).

In order to better answer the research question, 'What is the relationship between empathy and the everyday behaviors and development of children?' We have defined and researched literature around the following hypotheses.

Children change as they grow older. Research has shown that empathy increases from childhood to adolescence (Dymond et al., 1952). This develops in concurrence with cognition. In addition to cognition and empathy shifting with age, sensation seeking increases throughout childhood and peaks between 16 and 19 (Kafry, 1982). There are many studies that individually compare age to one of these factors, however there are no other studies that compare age to all of these elements at the same time. By searching for correlations between age and all of these traits, this study is able to compare the development of each of these traits. In line with the research, we hypothesize that age will be correlated with cognitive functioning, sensation seeking, and empathy.

Empathy development is incredibly important because it shapes social interactions. In fact, there is a close positive relationship between empathy and social competence and a negative relationship between empathy and antisocial behavior (Eisenberg, 2006). Although there have been many studies investigating the general impact of empathy on prosocial and antisocial behaviors of adults, research is lacking in regards to the children and adolescents. We hypothesize that the trend will remain the same in children as adults, so empathy will be positively correlated with prosocial behaviors and negatively correlated with antisocial behaviors.

Sensation seeking has been known to be correlated with rule-breaking behavior (Jensen et al., 2011). However, further research is needed to investigate how sensation seeking impacts

children's social behaviors. In light of the correlations between high sensation seeking and general conduct issues (Haas, 2019) and low affective empathy and bullying (Jolliffe and Farrington, 2006), we hypothesized that high sensation seeking will interact with low empathy and lead to deficits in interpersonal functioning.

In order to gain a holistic understanding of the relationship between empathy and the behaviors of children, it is important to understand how screen usage is affecting them. From 2019 to 2021, the average screen usage rose to an average of 5.33 hours in children ages 8 to 12 and it rose to 8.39 hours in children ages 12 to 19 (Common Sense Media, 2022). As screen usage increases, it is undoubtedly impacting children's development. There is substantial research into the impact of screen usage on cognition. Researchers have found that the way that screens are utilized impacts the development of problem solving skills (Zhang et al., 2021), strategic video game play had particularly a positive impact on problem solving skills and academic performance (Adachi & Willoughby, 2013). This study aims to draw more general conclusions in regards to the impact of screen usage on the average child's working memory, executive function, and cognitive control ability. We hypothesize that general screen usage will follow the same trend as strategic video games and that students who use screens as a part of their hobbies will have better cognitive function than students who do not.

Methods

Participants

The participants consisted of 116 primary students. These students ranged between the ages of 5 and 13. There was a mean age of 8.66 with a standard deviation of 2.21. Zero data points were excluded. These students were tested from primary schools across Dundee in Scotland and

Galway in Ireland. Two boys and two girls were tested from each classroom, meaning that 50% of the participants were female and 50% were male. Since this study was conducted for training purposes, there was no informed consent or compensation. Each classroom's teacher chose the potential candidates; they were asked to randomly select 4 of their students.

Materials and Measures

Demographics Questionnaire. A demographics questionnaire was created for this study (Brennan, 2016). Participants self-reported their age, birth date, gender, num ber of siblings, birth order, hobbies and interests, country (either Ireland or Scotland) and favorite school subject. Experimenters made a note regarding how many of the participants' hobbies require a screen.

Trail Making Task. The two-part Trail Making Test was administered to each child (Reitan & Wolfson, 1985). In the first part of the test, Trails A, each child participant was asked to draw a "trail" (continuous line) connecting 25 numbers on a sheet of paper in sequential order as quickly and accurately as possible without lifting the pencil. Total completion time was recorded. Trails A total completion time was used as a measure of working memory. In the second part of the test, Trails B, each child participant was asked to draw a trail between 13 numbers and the letters A-L in ascending order, alternating from numbers to letters (e.g., 1 – A – 2 – B), as quickly and accurately as possible without lifting the pencil. Total completion time was recorded. Faster Trails B completion times indicated higher executive function ability and cognitive control ability, since Trails B requires cognitive control to alternate quickly between the two sequence types (numbers and letters) and inhibit the prepotent tendency to move from each item in each well-learned sequence to the next one (e.g., moving correctly from 1 to A rather than the prepotent, over-learned tendency to move from 1 to 2).

Empathy Questionnaire for Children and Adolescents (EmQue-CA). Participants' level of empathy was measured using a slightly altered version of the Empathy Questionnaire for Children and Adolescents (EmQue-CA) (Overgaauw, 2017). Each child was read a statement (such as "If my mother is happy, I also feel happy") and asked to rate it: (1) not true, (2) sometimes true, or (3) often true. This questionnaire was meant to assess three parts of empathy: affective empathy, cognitive empathy, and intention to comfort (Overgaauw, 2017). Each of the 18 questions were divided into subscales. In 7 questions, the first subscale measured affective empathy and it asked questions like "If a friend is laughing, I also laugh". Many of the children had difficulty understanding the word "quarrel" in one of these questions, so it was dropped. After this alteration, affective empathy had an alpha reliability score of 0.61 that was deemed adequate. Cognitive empathy was assessed using 5 questions such as "when a friend is angry, I tend to know why". It had an alpha reliability score of 0.63 that was adequate. Intent to comfort utilized 6 statements such as "I would like to help when a friend gets angry" and had a reliability score of 0.71 which was good.

Sensation Seeking Scale for Children (SSSC). The SSSC was administered to each child to assess sensation seeking (Morrongiello & Lasenby, 2006). Each child was read two statements and asked to indicate which seemed more like them. This questionnaire was meant to assess 5 parts of sensation seeking, most notably including: thrill seeking, behavioral intensity, and disinhibition. Each of the 27 questions were divided into subscales. In 10 questions, the first subscale measured thrill seeking and it asked questions such as "I would like to try mountain climbing." or "I think people who do dangerous things like mountain climbing are foolish." It had a reliability score of 0.75 that was deemed good. Behavioral intensity, favoring intense activities over subdued ones (Morrongiello & Lasenby, 2006), was assessed by using 7 questions

such as "I wouldn't be afraid to climb to the very top of a tall ladder" or "climbing to the very top of a tall ladder sounds scary to me". It had an alpha reliability score of 0.60 this was sufficient. Disinhibition utilized 9 statements such as "even if I want to, it is hard for me to keep a secret" or "keeping secrets is easy for me" and had a reliability score of 0.60 which was sufficient.

Behavioral observation measure. The behavioral observation measure was conducted while the participants were freely playing with their peers. The experimenters spent a ten-minute interval watching the children. They took note of if students exhibited prosocial behavior (sharing a toy) or antisocial behavior (arguing). These scores were totaled to create each student's total prosocial and antisocial score. At the end of this period, experimenters rated students' social competence, social influence, social seeking, and general interaction style on a scale of 1 to 5.

In order to assess reliability, a second sample was taken for 25% of the subjects. This was used to calculate interrater reliability. The interrater reliability was assessed using intraclass correlation for each part of the behavioral observation. Social competence had a reliability score of 0.70 this was deemed good. Social influence had a reliability score of 0.80 which is also good. Social seeking had a reliability score of 0.71 a good score. General interact style had a good reliability score of 0.77. Prosocial and antisocial behavior both had reliability scores of 0.78 which was good.

Procedure

Each of the 29 experimenters individually tested 4 students. Testing sessions took place within the school, generally outside of the classroom, in quiet common areas or hallways. Most of the testing occurred during one approximately 20 minute session, the experimenter started by

verbally administering the Demographics Questionnaire. Next, they asked the children to answer the SSSC. This was immediately followed by the Trail Making Test and then the EmQue-CA measure. Behavioral Observations were conducted at another time within the two week testing period. They were taken during free play, while students were amongst their peers.

Data Analysis Plan

In order to assess the data, experimenters utilized IBM SPSS Statistics software. Results were deemed statistically significant when they had a p-value below 0.05. Using Pearson's r, correlation was assessed between age and cognitive function, empathy, and sensation seeking. It was also assessed for empathy and positive social behaviors. Using a linear regression and SPSS PROCESS, correlation was measured by using empathy to predict prosocial behavior and antisocial behaviors with disinhibition as the moderator. Additionally, independent sample t-tests were utilized to compare Trail Making Test times between children who used screens and children that did not.

Results

Descriptive statistics and preliminary analyses

Table 1 highlights the mean and standard deviations. It includes the mean and standard deviation of age, Trails A time, Trails B time, affective empathy, disinhibition, total prosocial behaviors, and total antisocial behaviors. Although there are no correlations, this table shows that, on average, participants demonstrated more prosocial than antisocial behaviors. Also, generally, disinhibition was much higher than affective empathy and Trails A time was lower than Trails B time.

Table 2 shows the intercorrelation between cognitive measures and sensation seeking measures. This table shows the Pearson's *r* coefficients for correlations between Trails A time, Trails B time, disinhibition, behavior intensity, and thrill seeking. There was a positive correlation between Trails A time and Trails B time in addition a negative correlation between Trails A time and behavioral intensity. Logically, there was also a negative correlation between Trails B time and behavioral intensity. Additionally, disinhibition was negatively correlated with behavioral intensity and thrill seeking. Finally, thrill seeking was positively correlated with behavioral intensity.

Table 3 shows the intercorrelations between behavior observation measures on the playground. The positive correlation between social influence and prosocial behaviors was expected. There were no additional correlations between antisocial and prosocial behaviors or social influence and antisocial behaviors.

Tests of Primary Hypotheses

The first hypothesis was that age will be correlated with cognitive function, empathy and sensation seeking. As shown in Table 4, there was a positive correlation between age and cognitive empathy. There was also a positive correlation between age and intent to comfort. Age was negatively correlated with both Trail A and Trail B times (indicating better performance). This supports the hypothesis that age is correlated with cognitive function and empathy. On the other hand, there was no correlation between age and affective empathy or age and disinhibition.

The second hypothesis was that empathy will be correlated with positive and negative behaviors. As shown in Table 5, there was a negative correlation between intent to comfort and antisocial behaviors; this supports the hypothesis. However, there was no significant correlation

between affective empathy, cognitive empathy, or intent to comfort and any of the other social behaviors (prosocial behaviors, antisocial behaviors, or social influence).

The third hypothesis was that empathy will interact with sensation seeking to predict prosocial and antisocial behaviors. There was no significant relationship between empathy and antisocial behaviors when moderated by disinhibition ($t = 0.48$, $p = 0.63$). However, there was a significant correlation between empathy and prosocial behaviors moderated by disinhibition ($t = -2.02$, $p = 0.05$). Figure 1 was created to show the relationship between prosocial behavior and affective empathy. As shown, affective empathy primarily predicts prosocial behavior for children that have low disinhibition. This supports the idea that the relationship between empathy and prosocial behaviors interacts with sensation seeking. However, there was no significant relationship between empathy and disinhibition in regard to antisocial behaviors ($t = 0.48$, $p = 0.63$).

The fourth hypothesis was that students who use screens as a part of their hobbies (47% of the sample) will have better cognitive function than students who do not use screens for their hobbies (53% of the sample). This was supported by the data. Children who listed at least one hobby with a screen had a significantly lower time for Trail Test A (indicating better performance) compared to children who did not list any hobbies involving screens ($t = 1.87$, $p = 0.01$). The same was not true for test B ($t = 1.57$, $p = 0.29$). For the behavioral measures, there were no significant differences between the groups for disinhibition ($t = -0.62$, $p = 0.91$) or empathy ($t = -0.50$, $p = 0.43$).

Discussion

This study explored the relationship between empathy and the behaviors and development of children. In order to examine this subject, we looked at cognitive functioning, sensation seeking, social behaviors, and screen usage in children in Ireland and Scotland. We predicted that age would be correlated with the first three of these measures. We anticipated that empathy would be correlated with social behaviors and that sensation seeking would also interact with empathy to predict these social behaviors. Finally, we predicted that screen usage would lead to better cognitive function. The data and results proved some of the hypotheses and was inconclusive in others.

Discussion of first hypothesis: correlation between age and cognitive function, empathy, and sensation seeking

Our first hypothesis was that age will be correlated with cognitive function, empathy and sensation seeking. It was partially supported. The data indicated that there was a positive correlation between age and cognitive function, age and cognitive empathy, and age and intention to comfort. However, there was no correlation between age and affective empathy or age and sensation seeking.

The data supported the idea that age is correlated with cognitive functioning and parts of empathy (cognitive empathy and intent to comfort). This remains consistent with literature that states that empathy increases with age. In a study by Dorris et al in 2022, they found that cognitive empathy increased between the ages of 6 to 7 and 10 to 12 years old.

The data did not support a correlation between age and affective empathy. This fits into the literature since there are mixed assertions regarding how affective empathy develops. Many of these studies have found that affective empathy remains stable throughout preschool and primary school age (Bensalah et al., 2016). However, since the other two parts of empathy

increase with age, we can still conclude that overall empathy increases with age, which supports the hypothesis.

On the other hand, there was no correlation between age and sensation seeking (measured through disinhibition). Although this was not hypothesized, it could have occurred because of the age distribution of our data. Studies have found that age differences in sensation seeking are closely linked with pubertal maturation (Steinberg et al., 2008). Since puberty begins between the ages of 8 and 14.9 in girls and 9.7 and 14.1 in boys (Lee, 1980), this simply does not fit into our sample. The average age of the participants in this data is 8.66 years old, so any correlation within children experiencing puberty would not appear.

As such, the hypothesis is mostly supported, we found links between age and empathy and age and cognitive functioning. However, the data was not suitable to draw any conclusions in regards to the relationship between age and sensation seeking.

Discussion of second hypothesis: correlation between empathy and social behaviors

Our second hypothesis was that empathy will be positively correlated with prosocial behaviors and negatively correlated with antisocial behaviors. This was partially supported. The data indicates that there was a negative correlation between intent to comfort and antisocial behaviors. However, there were no other significant correlations between affective empathy, cognitive empathy, or intent to comfort and prosocial or antisocial behaviors.

It is unsurprising that children who are high in intent to comfort are low in antisocial behaviors. Intent to comfort measures how inclined an individual is to help someone in distress. Someone who is likely to help others in distress is unlikely to cause them distress.

It is initially shocking that there is no correlation between affective empathy, cognitive empathy, or intent to comfort and prosocial or antisocial behaviors but revisiting each of these subtypes individually explains the lack of correlation.

Higher affective empathy is linked to better conflict resolution between peers (De Wied et al., 2007). However, it is also linked to relationship difficulties because some individuals are high in affective empathy and low in either emotional regulation or cognitive empathy. In these cases, they have difficulty supporting people in distress (Pouw et al., 2013). For instance, if they were to encounter an upset friend, someone high in affective empathy would feel upset as well. If they did not have ample emotional regulatory abilities then they would be too upset to help. If they lacked cognitive empathy, then they would not be able to discern why their friend was upset or how to help them. Affective empathy is a motivator; however, if a child lacks the ability to resolve the situation, then having higher affective empathy does not increase prosocial behavior nor does it decrease antisocial behavior if the child cannot understand how their actions will affect others.

On the other hand, cognitive empathy means that a child is more likely to understand why their peers are in distress, yet if they lack affective empathy and/or intent to comfort, then they will not feel any motivation to engage in prosocial behavior or to prevent themselves from engaging in antisocial behavior.

Empathy is linked to prosocial behavior (Eisenberg, 2006) but a single subtype of empathy alone is not a sufficient predictor of prosocial behavior. Limiting antisocial behavior requires ample amounts of self control. Without proper motivation or understanding, affective empathy or cognitive empathy alone is not enough to limit this behavior. Since someone with a

higher intent to comfort wants to help other people, it is logical that this is negatively associated with antisocial behavior.

Discussion of third hypothesis: correlation between empathy and social behaviors as moderated by sensation seeking

Our third hypothesis was that empathy will interact with sensation seeking to predict prosocial and antisocial behaviors. It was partially supported. The data indicated that there was a significant relationship between empathy and prosocial behaviors when moderated by disinhibition. However, there was no significant relationship between empathy and antisocial behaviors when moderated by disinhibition.

It is important to note that affective empathy best predicts prosocial behavior for individuals with low disinhibition. This means that sensation seeking has an effect on the execution of prosocial behavior. Between two individuals with the same empathy, the individual with higher inhibitory control will be better able to fulfill their altruistic desires without interference from their impulses.

Initially, it is surprising that when moderated by disinhibition, there is no significant relationship between empathy and antisocial behaviors. Other research into this topic states that there are correlations between high sensation seeking and conduct issues (Haas, 2019) but there is also evidence that is positively correlated with lower stress (Mckay et al., 2018), meaning that individuals high in sensation seeking are better able to handle their stress and therefore less likely to lash out against others. The two dimensions of sensation seeking likely work alongside each other and result in a nonsignificant impact on the interactions between empathy and antisocial behavior.

Discussion of fourth hypothesis: better cognitive functioning in students who use screens for their hobbies

Our fourth hypothesis was that students who use screens as a part of their hobbies will have better cognitive function then students who do not use screens for their hobbies. It was partially supported. The data shows that children who listed at least one screen for their hobby showed significantly better cognitive performance on Trail Test A but they did not show better performance on Trail Test B.

Trail Test A assesses working memory. As such, the significant relationship between screen usage and cognitive performance on Trail Test A aligns with the literature that has found an association between screen usage and working memory in adolescent males (Soares et al., 2021). On the other hand, Trial Test B assesses executive function and cognitive control. There was no significant correlation between screen usage and cognitive performance on Trail Test B, which is consistent with other findings which have concluded that high screen time is associated with an increased risk of executive functioning problems (Vohr et al., 2021).

Limitations

This study must be interpreted in consideration of its limitations. Firstly, due to the self-reported nature of the questionnaires, there may have been bias in the respondent's answers to both the EmQue-CA and SSSC. This may be particularly prominent on empathy results due to the clarity of the questions. The questions were straightforward, meaning that it was trivial to determine what responses would score a higher or lower empathy score. This may have decreased the face validity of the test.

Secondly, due to the cross sectional design of the study, all of the data is the result of a single two week testing period. As such, it is impossible to determine if the time served as a

confounding factor. For instance, behavioral observations for each child were taken during a single 10-minute time period. Any number of factors could have altered the participants' environment and emotional state, making it less representative of their general behavior.

Thirdly, since 29 researchers collected the data, there is slight variability in between test administrations. This is particularly notable for playground observations in which researchers had to assign subjective ratings to children’s social abilities. In order to combat potential bias, interrater reliability was assessed and consistently deemed either sufficient or good. Nevertheless, it is important to note this as a source of potential bias.

Additionally, since researchers asked classroom’s teacher to randomly select participants, there may be a small element of selection bias.

Finally, participants’ screen usage was measured using whether or not they listed any hobbies that utilize a screen. This does not properly record the amount of time that each individual spends on an electronic device. Checking participants' average screen time per day would have had more validity.

Future Directions

It would be worthwhile to further research the relationship between empathy and sensation seeking in teens. We found that age was, for the most part, significantly correlated with empathy but there was no correlation between age and sensation seeking. This means while there was a significant increase of empathy with age, sensation seeking did not significantly shift and remained relatively stable. This would vary in older adolescents, since sensation seeking tends to increase during puberty (Steinberg et al., 2008). As such, it would be interesting to investigate how empathy and sensation seeking interact, and if they continue to maintain a significant correlation between empathy and prosocial behaviors moderated by disinhibition longitudinally.

Additionally, the hypothesis that screen using participants will have higher cognitive functioning was partially supported. Since screen usage is very relevant, it would be worthwhile to further investigate the impact of screen usage on other traits, such as sensation seeking.

Conclusion

This study aimed to investigate the relationship between empathy and the behaviors and development of children. The results of this study indicate that cognitive function, cognitive empathy, and intent to comfort are positively correlated with age. They also show that there is a negative correlation between intent to comfort and antisocial behaviors; furthermore, there is a correlation between empathy and prosocial behaviors when moderated by disinhibition. Additionally, we found that screen usage is linked to better working memory. This aligns with the literature and helps to explain how these traits interact to shape the behaviors of children as they grow older. Understanding the correlation between all types of empathy and prosocial and antisocial behavior may guide teachers and counselors on proper methods to educate and adjust behavioral patterns in young children as they mature.

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