

Henna Helsiaho & Venla Karppinen

# **THE CONNECTION BETWEEN ALEXITHYMIC TRAITS AND CHILDREN'S ABILITY TO INFER EMOTIONS FROM FACIAL EXPRESSIONS**

Faculty of Social Sciences  
Bachelor's thesis in Psychology  
May 2023

# TIIVISTELMÄ

Henna Helsiaho & Venla Karppinen: Aleksitymisten piirteiden yhteys lasten kykyyn päätellä tunteita kasvojen ilmeistä.

Kandidaatintutkielma

Tampereen yliopisto

Psykologian tutkinto-ohjelma

Toukokuu 2023

Tämän tutkimuksen tarkoituksena oli tarkastella aleksitymisten piirteiden yhteyttä suomalaisten lasten kykyyn tunnistaa tunnetiloja kasvonilmeistä. Aleksitymialla tarkoitetaan yksilön vaikeutta tunnistaa, erotella ja nimetä omia tunteitaan, ja sen on tutkittu olevan yhteydessä mielenterveyden häiriöihin sekä sosiaalisiin haasteisiin. Lisäksi aleksitymian on havaittu olevan yhteydessä heikentyneeseen kykyyn tunnistaa toisten tunnetiloja. Ensimmäinen tutkimuskysymyksemme oli, ennustavatko aleksitymiset piirteet suoriutumista kasvonilmeiden tunnistamista mittaavassa tehtävässä. Aiempien tutkimusten perusteella hypoteesimme oli, että lapset, joilla on enemmän aleksitymisia piirteitä suoriutuvat heikommin kasvonilmeiden tunnistustehtävässä. Toinen tutkimuskysymyksemme oli, ennustavatko aleksitymiset piirteet kasvonilmeiden tunnistustehtävän suorittamiseen kulunutta aikaa. Aiempaan tutkimukseen perustuva hypoteesimme oli, että lapset, joilla esiintyy enemmän aleksitymisia piirteitä, käyttävät kasvonilmeiden tunnistustehtävään enemmän aikaa. Aiemmin aihetta on tutkittu aikuisilla, mutta lapsilla tehtyä tutkimusta on vähän. Tämä tutkimus tutki tutkimuskysymyksiämme ensimmäistä kertaa suomalaisilla lapsilla.

Tutkimusaineisto on osa Tunteet läpi elämän -tutkimusprojektia, ja se kerättiin Tampereen yliopistossa vuonna 2021. Tämän tutkimuksen aineisto koostui 52 suomalaisesta 10–15-vuotiaasta lapsesta. Osallistujat vastasivat tunnetietoisuutta kartoittavaan itsearviointikyselyyn (Emotion Awareness Questionnaire, EAQ) sekä tekivät perustunteita esittävien kasvojen ilmeiden tunnistamista mittaavan tietokoneavusteisen FEFA-2-testin. EAQ-kyselystä tutkimme osa-alueita, jotka mittaavat kykyä erotella tunteita, kykyä sanallistaa tunteita sekä kehotietoisuutta. FEFA-2-testin tuloksista tarkastelimme oikein tunnistettujen ilmeiden lukumäärää sekä testin suorittamiseen kulunutta aikaa. Aleksitymian yhteyttä kykyyn tunnistaa tunnetiloja kasvonilmeistä tutkittiin korrelaatio- ja regressioanalyysillä.

Aineistossamme aleksitymiset piirteet eivät ennustaneet kasvonilmeiden tunnistustehtävässä suoriutumista. Aleksitymian osa-alueista kyky erotella tunteita ja kyky sanallistaa tunteita eivät tulostemme perusteella myöskään ennustaneet kasvonilmeiden tunnistustehtävän suorittamiseen kulunutta aikaa. Ristiriidassa oletuksemme kanssa aleksitymian kehotietoisuutta mittaava osa-alue ennusti kasvonilmeiden tunnistustehtävän suorittamiseen kulunutta aikaa niin, että heikompi kehotietoisuus ja näin korkeampi aleksitymia ennusti nopeampaa suoriutumista kasvonilmeiden tunnistustehtävässä.

Tutkimustulostemme perusteella aleksitymiset piirteet eivät siis ole merkittävä ennustaja kyvyssä päätellä tunnetiloja kasvonilmeistä. Tutkimuksessamme oli kuitenkin useita rajoitteita, ja tuloksemme ovat ristiriidassa aiempien tutkimusten kanssa. Näistä syistä johtopäätökset tutkimuksestamme on tehtävä varovaisuudella. Jotta aleksitymisten piirteiden yhteyksiä kykyyn tunnistaa kasvojen ilmeitä voidaan ymmärtää paremmin, tarvitaan lisätutkimusta erityisesti lapsilta useista eri kulttuureista.

Avainsanat: aleksitymia, tunnetaidot, tunnetietoisuus, kasvonilmeet, lapset

Tämän julkaisun alkuperäisyys on tarkastettu Turnitin OriginalityCheck –ohjelmalla.

# ABSTRACT

Henna Helsiaho & Venla Karppinen: The connection between alexithymic traits and children's ability to infer emotions from facial expressions.

Bachelor's thesis

Tampere University

Degree Programme in Psychology

May 2023

---

The aim of this study was to examine the connections between alexithymic traits and Finnish children's ability to recognize emotions from facial expressions. Alexithymia refers to an individual's difficulty to recognize, differentiate and name one's own emotions, and it has been associated with mental disorders and social difficulties. In addition, alexithymia has been linked to decreased ability to recognize others' emotions. Our first research question was whether alexithymic traits predict the performance in a facial emotion recognition task. Based on previous research, we hypothesized that children with more alexithymic traits perform poorer in the facial emotion recognition task. Our second research question was whether alexithymic traits predict the time spent completing the facial emotion recognition task. Based on previous research our hypothesis was that children with more alexithymic traits take more time completing the task. The subject has been previously studied in adults, but the research in children is limited. This study examined these questions for the first time in Finnish children.

Our research data was part of the "Tunteet läpi elämän" research project and was collected in Tampere University in 2021. The data consisted of 52 Finnish children between the ages of 10 and 15. The participants filled out a self-assessment Emotion Awareness Questionnaire (EAQ) and completed a computer-assisted facial emotion recognition task FEFA-2 displaying pictures of basic emotions. From the EAQ we examined those factors that measure the ability to distinguish emotions, verbalize emotions and bodily awareness. From the FEFA-2 task, we examined the number of correct answers and the time spent completing the task. We examined the connections between alexithymia and the ability to recognize emotions from facial expressions with correlations and regressions analysis.

In our data alexithymic traits did not predict the performance in the facial expression recognition task. Out of the alexithymia factors, the ability to differentiate emotions and the ability to verbalize emotions did not predict the time taken completing the facial expression recognition task either. Contrary to our assumption, the alexithymia factor assessing bodily awareness predicted the time taken completing the facial emotion recognition task with weaker bodily awareness, and thus higher alexithymia, predicting faster completion of the facial emotion recognition task.

According to our results alexithymic traits are not a significant predictor in the ability to infer emotions from facial expressions. However, in our study there were several limitations, and our results contradict previous research. Because of these reasons, conclusions from our study should be made with caution. To understand the connections between alexithymic traits and the ability to recognize facial expressions better, more research especially about children from several different cultures is needed.

Keywords: alexithymia, emotional abilities, emotion awareness, facial expressions, children

The originality of this thesis has been checked using the Turnitin OriginalityCheck service.

## TABLE OF CONTENTS

1. INTRODUCTION .....	1
1.1. Alexithymia .....	2
1.2. Facial emotion recognition .....	4
1.3. The connections of alexithymia and facial emotion recognition .....	5
1.4. Research questions and hypotheses .....	7
2. METHODS .....	7
2.1. Participants .....	8
2.2. Procedure and measures .....	8
2.3. Statistical analyses .....	10
3. RESULTS .....	11
3.1. Descriptive statistics.....	11
3.2. Accuracy in FEFA-2 .....	12
3.3. FEFA-2 completing speed.....	13
4. DISCUSSION .....	14
4.1. Alexithymia and facial emotion recognition .....	14
4.2. Strengths and limitations .....	17
4.3. Ideas for further research.....	18
4.4. Conclusions.....	19
REFERENCES .....	21
APPENDIX .....	28

## 1. INTRODUCTION

Emotion is a complex reaction pattern with physiological, experiential, and behavioral aspects, and it arises in a response to a personally significant event or matter (APA Dictionary of Psychology, n.d.). Emotions guide our navigation in a world full of sensory information, evoke adaptive behavior, and help adequately communicate our needs to other people (Nesse & Ellsworth, 2009; Tooby & Cosmides, 2008). For instance, expressing anger can be a way of signaling dissatisfaction with the actions of others and can influence changes in these actions. Understanding and describing our emotions is an important skill that is also connected to other emotional abilities, such as empathy and emotion regulation (Swart et al., 2009). The difficulty in recognizing and describing one's own emotions is called alexithymia (Grynberg et al., 2012; Sifneos, 1973). Alexithymia has diverse influences on an individual's life, with links to, for example, lower relationship satisfaction (Humphreys et al., 2009) and various psychiatric disorders (e.g., Leweke et al., 2011).

To successfully use expressions of emotion as a tool of social communication, one does not only need to recognize one's own emotions but also be able to accurately recognize and interpret the emotions of other people. The capacity for emotion recognition develops from the very early stages of life, and it creates a foundation for prosocial behavior and empathy (Frith & Frith, 2007). One of the essential means of expressing emotion is through facial expressions. Facial emotion recognition has been linked to mental wellbeing through social competence (Bornhofen & McDonald, 2008) and different mental disorders (Kohler et al., 2010; Kohler et al., 2011; Saure et al., 2022). It is also affected by factors like culture (Jack et al., 2009) and early social environments (Laamanen et al., 2022).

Studying the connections between alexithymia and recognizing the emotions of other people is crucial to further understanding alexithymia. The effects of alexithymia on facial emotion recognition have been studied to some extent in adults, but the research on the topic in children is rather limited. Our study brings a new perspective to the study of emotional abilities by studying these connections in a sample of Finnish children. Social emotional development is significant in childhood, which makes understanding the appearance of alexithymic traits in the earlier stages of life important. Moreover, our Finnish data can shed light on the possible cultural differences within the phenomenon.

## 1.1. Alexithymia

The term alexithymia was originally developed in the seventies by Sifneos who studied psychiatric patients and described alexithymia as a difficulty finding words for emotions, impoverished fantasy life and concrete ways of thinking (Sifneos, 1973). It is defined by difficulties in recognizing and verbally expressing one's own emotions (Grynberg et al., 2012; Sifneos, 1973). The literal translation of alexithymia is "without words for emotions" (e.g., Sifneos, 1973). Alexithymia is often characterized and measured by three factors: difficulty identifying feelings (DIF), difficulty describing feelings (DDF), and externally-oriented thinking (EOT) (Toronto Alexithymia Scale TAS-20; Bagby et al., 1994). This classification shows that alexithymia does not only refer to impoverished ability to recognize and distinguish one's own feelings but also to a cognitive style that is oriented toward external experiences instead of internal (Franz et al., 2008). For instance, Sifneos (1973) described alexithymic people as having a practical way of thinking, focusing on action instead of one's own feelings. It is seen as a normally distributed personality trait rather than a psychiatric condition (Franz et al., 2008). Some studies have shown men to have higher scores of alexithymia compared to women (e.g., Bagby et al., 1994; Levant et al., 2009), but this result has not been replicated in every study (e.g., Franz et al., 2008). The assumption of men having more alexithymic traits is referred to as the normative male alexithymia hypothesis (Levant, 1992).

The development of alexithymia can be examined from various perspectives. One study shows that genetic factors explain about 42 % of individual differences in alexithymia (Picardi et al., 2011). Some other studies, however, have examined environmental factors that might contribute to the development of alexithymia. For instance, according to Joukamaa et al. (2008), there is a relation between alexithymia and childhood neglect and abuse. Parents' and children's alexithymia also seem to correlate with each other (López et al., 2018). These previous findings suggest that alexithymia, like any personality construct, is developed by both nature and nurture. The normative male alexithymia hypothesis also brings forward environmental factors, suggesting that men could have higher levels of alexithymia due to socialization, which discourages men from showing or understanding their emotions (Levant, 1992).

The ability to recognize and interpret one's emotions is extensively associated with other emotional abilities. People with high scores of alexithymia seem to use less efficient emotion regulation strategies like suppression and withdrawal (Preece et al., 2023; Swart et al., 2009). People with high scores of alexithymia have also shown lower levels of empathy (Swart et al., 2009). Swart et al. (2009) suggested that empathy requires the understanding of others' emotions, which likely

relies on understanding one's own feelings. Although alexithymia is typically seen as an inability to describe and recognize one's own emotions, it has also been associated with poorer recognition of other people's emotional expressions (Di Tella et al., 2020). Emotions and emotional abilities play an important role in everyday social interactions and relationships. Therefore, it is not surprising that people with high scores of alexithymia have reported, for instance, lower relationship satisfaction and more withdrawal from social situations (Humphreys et al., 2009; Iannattone et al., 2021).

High scores of alexithymia have also been linked to a variety of psychiatric disorders. These include, for instance, depression, anxiety disorders, eating disorders like anorexia nervosa, and different personality disorders (Gramaglia et al., 2016; Leweke et al., 2011; Nicolò et al., 2011). Alexithymia seems to predict lower health-related quality of life, which concerns factors such as sleeping, eating, mental functioning, and distress (Mattila et al., 2009). These results suggest that one's ability to recognize and differentiate emotions has impacts on both physical and psychological health. Connections have also been found between alexithymia and autism spectrum disorder (ASD), and it has been proposed that co-occurring alexithymia could cause more emotional deficits in ASD (Griffin et al., 2016, Shah et al., 2016).

Most of the previously mentioned studies have researched alexithymia in adult populations. Studies about the impacts of alexithymia on children are limited compared to those in adults, although some have been done (e.g., Rieffe et al., 2007; Scheerer et al., 2021). Alexithymia is, for instance, associated with poorer social competence in children both with and without autism spectrum disorder (Scheerer et al., 2021). Alexithymia has also been connected to disordered eating and emotional eating in children and adolescents (Shank et al., 2019). These findings are in line with the previously mentioned results of similar studies in adults. Considering alexithymia's various impacts on people's emotional abilities and mental health, it is also relevant to understand alexithymia in children.

The TAS-20 questionnaire (Bagby et al., 1994) is typically used when studying alexithymia in adults. Several questionnaires have been developed to measure alexithymia in children, such as the Alexithymia Questionnaire for Children (AQC; Rieffe et al., 2006), Children's Alexithymia Measure (CAM; Way et al., 2010) and the Emotion Awareness Questionnaire (EAQ; Rieffe et al., 2007). In this study, we use the EAQ, which is partially based on both TAS-20 and the Alexithymia Questionnaire for Children, and consists of six factors (Rieffe et al., 2007). The EAQ measures emotional awareness, which is a slightly broader concept than alexithymia (Rieffe et al., 2007). According to Rieffe et al. (2007), emotional awareness includes, for instance, factors like the willingness to face one's own emotions and one's attention to others' emotions, which are outside of the traditional concept of alexithymia. In our study, we focus on the factors Differentiating Emotions,

Verbal Sharing of Emotions and Bodily Awareness of the EAQ, which are based on the TAS-20 alexithymia factors.

## **1.2. Facial emotion recognition**

Making interpretations of other people's emotional states from their facial expressions is a part of nonverbal communication and social interaction. The development of facial emotion recognition is rapid during childhood (Chronaki et al., 2015). Facial emotion recognition abilities start to develop in early infancy (Leppänen, 2011), and are shaped by the child's early social-emotional environments, such as early-life family environment (Laamanen et al., 2022). In their study, Laamanen et al. (2022) found that children from families with highly distressed relationships showed superior facial emotion recognition compared to children from cohesive families. On the contrary, in a study by Steele et al. (2008), children assessed as having an insecure attachment to their mothers at 1-year-old showed weaker facial emotion recognition at 6 years of age.

In addition to close social-emotional environments, broader environmental factors contribute to facial emotion recognition in children. According to Chester et al. (2023), the use of face masks during the COVID-19 pandemic affected the recognition of facial expressions in school-aged children, with the recognition of happy, sad, and fearful faces being worse from masked faces compared to unmasked ones. This effect was more prominent in children whose families practiced more social distancing, giving the children fewer opportunities to learn emotion recognition from masked faces. Additionally, when comparing facial emotion recognition of unmasked faces pre-pandemic and during it, recognition of sad faces worsened, while recognition of fearful faces improved across the pandemic. Thus, environmental factors seem to influence emotion recognition to some extent during its development.

The nature and universality of facial expressions have been under debate for a long time, with many suggesting six basic emotions that all have their own, universal facial expressions (Ekman & Friesen, 1971) and some challenging the universality of facial expressions altogether (Barrett, 2006; Jack et al., 2012). Influential studies from the 20<sup>th</sup> century (e.g., Ekman, 1992; Ekman & Friesen, 1971) propose that the basic emotions, enjoyment, anger, sadness, fear, disgust, and surprise, are innate and biologically determined and can be recognized across cultures, and that culture affects the appropriate ways and situations of displaying emotions. Some researchers propose that culture influences not only the expression of emotion in social settings but also the recognition of the facial



expressions of other people (Jack et al., 2009). According to Jack et al. (2009), the differences in recognizing emotional facial expressions can occur due to the different strategies used in decoding facial movements. In their study, the East Asian participants fixated more on the eye region of the face compared to the Europeans, thus leaving more room for confusion and different interpretations of the facial expressions. It has also been demonstrated that Westerners use more distinct sets of facial muscles in the expressions of different basic emotions, while in the expressions of Easterners the sets of muscles used overlap in several emotions (Jack et al., 2012).

Some studies have reported gender differences in facial emotion recognition. It has been demonstrated that women show better performance in recognizing emotional facial expressions in comparison to men, both in terms of speed (Hampson et al., 2006) and accuracy (Wingenbach et al., 2018). Other research, however, found no significant gender differences (Sawada et al., 2014; Vassallo et al., 2009). The results are contradictory, and so no clear consensus on the gender differences in facial emotion recognition has been reached.

The growing body of evidence suggests impaired ability in recognition of emotional facial expressions in several psychiatric disorders, such as major depressive disorder (Dalili et al., 2015), bipolar disorder (Kohler et al., 2011), schizophrenia (Kohler et al., 2010) and anorexia nervosa (Saure et al., 2022). Reduced ability in recognizing emotions from facial expressions has also been associated with impaired social competence (Bornhofen & McDonald, 2008). These possible adverse outcomes of difficulties in facial emotion recognition motivate further research on those abilities.

Numerous scales and methods have been developed to measure facial emotion recognition, like the Benton Test of Facial Recognition (Grynszpan et al., 2014) and Emotion Recognition Task (ERT; Prillinger et al., 2021), to name a few. In this study, we utilize the most widely used measure, FEFA-2, which is a development of a standardized computer-based measure The Frankfurt Test and Training of Facial Affect Recognition, FEFA (Bölte et al., 2002; Karolinska Institutet, n.d.). It is based on the basic emotion theory, which assumes there are six universal emotions that are expressed through specific facial expressions. FEFA targets these basic emotions and aims to measure individuals' ability to recognize and differentiate them from one another.

### **1.3. The connections of alexithymia and facial emotion recognition**

In general, studies on connections between alexithymia and facial expression recognition show that alexithymia has negative impacts on the ability to recognize emotional facial expressions (Di Tella et

al., 2020; Grynberg et al., 2012). Di Tella et al. (2020) studied multiple factors concerning facial emotion recognition, such as gender, education level, and anxiety symptoms, and found that alexithymia scores were the only variable that predicted the ability to recognize facial expressions. A study of facial emotion recognition using pictures of only eye-region of faces also showed that people with high scores of alexithymia had poorer performance compared to people with low scores of alexithymia (Martinez-Sanchez et al., 2017). In addition to this, in one study, participants with high scores of alexithymia looked less into the eye-region in the facial emotion recognition task, and that looking into the eye area in fact decreased their performance but not the performance of the lower alexithymia group (Fujiwara, 2018). Alexithymia seems to have a larger impact on recognizing anger, fear, and sadness from facial expressions compared to happiness, surprise, and disgust (Prkachin et al., 2009). It was suggested that anger, fear, and sadness are emotions that indicate some type of personal threat and may therefore be more challenging to process (Prkachin et al., 2009).

Alexithymia is associated with poorer performance in emotional facial expression labeling when the stimuli are presented for a short time, suggesting that the emotion recognition could take more time for participants with higher scores of alexithymia (Ihme et al., 2014). This suggestion is supported by the results of Parker et al. (2005) and Prkachin et al. (2009), who found that when given a generous amount of time, the individuals in the group with high alexithymia scores did not show major deficits in recognizing emotions from facial expressions. The ratings of the intensities of seen emotions, however, did significantly differ in the high alexithymia group from the group with low alexithymia, especially with the DIF and EOT factors correlating negatively with the ratings of the intensity of fear expressions (Prkachin et al., 2009). These results suggest that people with higher scores of alexithymia may need more resources (e.g., time) to process information from facial expressions.

Social interactions have an important role in people's lives and, according to previous research, could be negatively impacted by alexithymia (e.g., Humphreys et al., 2009). Some studies have also researched how impaired facial emotion recognition found in alexithymia could have associations with the quality of social interactions. A study found that the limitations in the recognition of facial expressions could be significant in mediating the negative impacts of alexithymia in social interactions (Kafetsios & Hess, 2019). As in other previously mentioned similar studies, this research found alexithymia to be linked with impaired and biased accuracy in labeling perceived facial expressions, and it was suggested that this has impacts on communication and dyadic interactions (Kafetsios & Hess, 2019). In Fujiwara's (2018) study on the impact of eye contact in facial emotion recognition, it was proposed that eye contact might be stressful or emotionally challenging for people with high scores of alexithymia, and hence possibly impeding interactions in

social situations. These studies bring forward how impaired facial emotion recognition linked with alexithymia could negatively impact interpersonal relationships important in our everyday lives, highlighting the importance of further understanding those associations.

#### **1.4. Research questions and hypotheses**

The aim of our study is to examine if there are links between alexithymia scores and the ability to infer emotional states from facial expressions in healthy Finnish children. To achieve this, we will examine the links between the EAQ scores and both FEFA-2 scores and the time spent completing the FEFA-2 test. Our first research question is whether the level of alexithymia predicts the performance in the facial expression recognition task. Based on previous studies suggesting association between alexithymic traits and poorer facial emotion recognition skills compared to non-alexithymic adults (Di Tella et al., 2020; Grynberg et al., 2012), we hypothesize that children with a higher alexithymia score show poorer performance in the facial expression recognition task.

The second research question in our study is whether the level of alexithymia predicts the time spent completing the facial expression recognition task. In accordance with results demonstrated earlier (Ihme et al., 2014; Prkachin et al., 2009) of people with high levels of alexithymia showing slower facial emotion recognition compared to people with low levels of alexithymia, we hypothesize that completing the facial expression recognition task takes more time for the children with higher alexithymia scores compared to those with lower alexithymia scores.

Our interest in these questions arises from the limited research done on the connections between alexithymia and facial emotion recognition in children. Considering that children are still developing their emotional and social skills, we find it important to study this topic in this context. Our aim is to further understand how children's awareness of their own emotions links to the ability to interpret others' emotional expressions, thereby providing more knowledge about children's emotional abilities and development.

## **2. METHODS**

## 2.1. Participants

The data used in our study was collected in Human Information Processing Laboratory at Tampere University as a part of the *Tunteet läpi elämän* research project (Academy of Finland, 2019-2022) aimed at studying the development of experienced emotions from childhood to adulthood. It consisted of 60 children and adolescents of 8–15 years of age. The sample of this current study consists of 52 healthy, typically developing Finnish children and adolescents between the ages of 10 and 15 ( $M = 11.9$ ,  $SD = 1.58$ ); 28 (53.8 %) of the participants were females. Participants were recruited through online advertisements on social media platforms and via mailing lists. Participants and their caregivers registered to participate in the study with an online form and were then invited to the laboratory to participate in the research. The data was collected during spring and summer of 2021.

Informed consent was gathered from the caregivers of the children between the ages of 10 and 14, while 15-year-old participants gave their own informed consent. Participants and their caregivers were informed that the researchers have an obligation to maintain confidentiality, and personal information would be seen and processed by the researchers only in accordance with data protection legislation. Participation in this research was voluntary, and discontinuation or withdrawal from the study was possible at any point.

This study was conducted in Finnish. First, the participants completed a Finnish version of the Emotion Awareness Questionnaire. After this, the participants completed the FEFA-2 test using a computer.

## 2.2. Procedure and measures

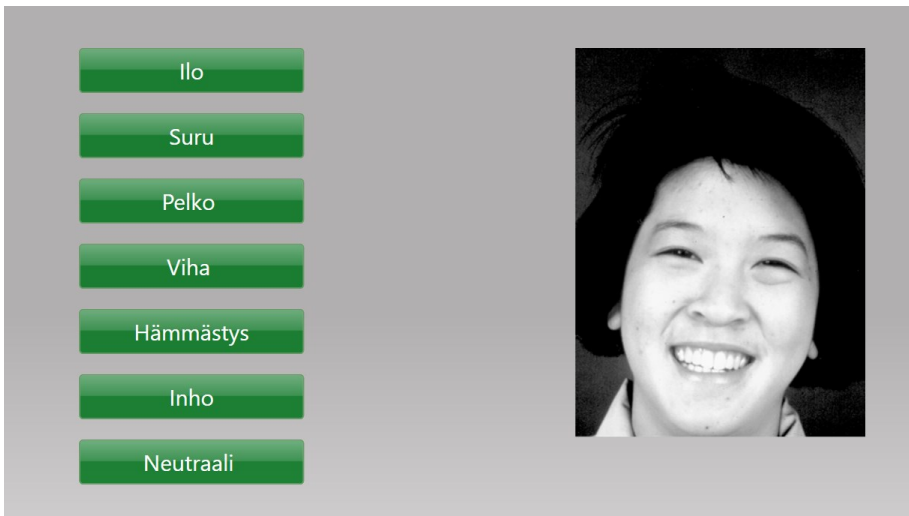
**Alexithymia** was measured using the Emotion Awareness Questionnaire (EAQ), which consists of 30 items. The EAQ is a self-assessment questionnaire and includes six factors: Differentiating Emotions, Bodily Awareness, Verbal Sharing of Emotions, Acting Out Emotions, Analyses of Emotions, and Others' Emotions (Rieffe et al., 2007). The factors Differentiating Emotions and Bodily Awareness are equivalent to the TAS-20 factor of Difficulty Identifying Feelings. The TAS-20 factor of Difficulty Describing Feelings is represented in the EAQ as the factor Verbal Sharing of Emotions. The factor Acting Out Emotions was added to the EAQ from outside of TAS-20 to distinguish between the blunt and nonverbal expression of one's emotions from Verbal Sharing of

Emotions. It has shown poor psychometric properties (Rieffe et al., 2007) and is outside of the concept of alexithymia. The factors Analyses of Emotions and Others' Emotions broaden into the children's willingness to face the emotions of their own and of other people and therefore are outside of the concept of alexithymia as well. Because of these differences between TAS-20 and the EAQ, we decided to leave out these three additional factors of the EAQ from our analyses and analyze only the following factors: Differentiating Emotions, Bodily Awareness and Verbal Sharing of Emotions. These three factors have 15 items in total. When examining Cronbach's alpha, the reliability of these three factors together seems to be at an appropriate level,  $\alpha = .74$ . The reliabilities for the factors separately are similarly appropriate (Cronbach's alphas: Differentiating Emotions:  $\alpha = .72$ ; Bodily Awareness:  $\alpha = .77$ ; Verbal Sharing of Emotions:  $\alpha = .70$ ).

The questionnaire contained items such as "I find it hard to explain to a friend how I am feeling", "I don't feel anything in my body when I am scared or nervous" and "I am never entirely sure what emotion I am feeling". The participants were asked to rate each statement on a scale of 1-3 (1 = not true, 2 = sometimes true, 3 = often true). In the factors Differentiating Emotions and Verbal Sharing of Emotions, a higher score means a higher presence of the corresponding ability; in Bodily Awareness a higher score represents lower attention to bodily symptoms.

**Facial emotion recognition** was assessed using the development of the Frankfurt Test and Training of Facial Affect Recognition, FEFA-2. In the facial emotion recognition test, the participants were shown 50 photos of faces displaying different basic emotions: joy, anger, sadness, fear, disgust, and surprise. The participants were asked to select the emotion that corresponds with the facial expression from a list of emotions. During the test, the number of correct answers and the time taken to complete the task were recorded. The participants completed FEFA-2 task using a computer.

**Image 1.** An example of a FEFA-2 item.



### 2.3. Statistical analyses

We analyzed our data using version 4.2.1 of RStudio statistical software (R Core Team, 2021). To examine the data, we used the package “Psych” (Revelle, 2022). To visualize our results, we used the packages “Ggplot2” (Wickham, 2016) and “Hrbrthemes” (Rudis, 2020). We employed the same statistical methods to answer both of our research questions.

Firstly, we investigated the relationship between alexithymia scores and FEFA-2 scores, using Pearson’s correlation coefficient. Specifically, we examined the correlations between the number of correct answers in FEFA-2 and the EAQ factors Differentiating Emotions, Verbal Sharing of Emotions and Bodily Awareness. To determine, whether the alexithymia scores predict performance in FEFA-2, we built a separate linear regression model for each of the EAQ factors, with the number of correct answers in FEFA-2 task as the dependent variable and the EAQ scores as independent variables. In the models we also controlled the effect of the age of the participant.

Secondly, we explored the second research question by analyzing the relationship between the EAQ factors and the time spent completing the FEFA-2 test using Pearson's correlation coefficient. For this research question, we built another three linear regression models to observe if alexithymia scores predict the time spent completing FEFA-2 task, with the time as the dependent variable and the EAQ scores as independent variables, simultaneously controlling the effect of age.

In summary, we utilized Pearson's correlation coefficient and linear regression models to investigate the relationships between alexithymia scores, FEFA-2 scores, and the time taken to

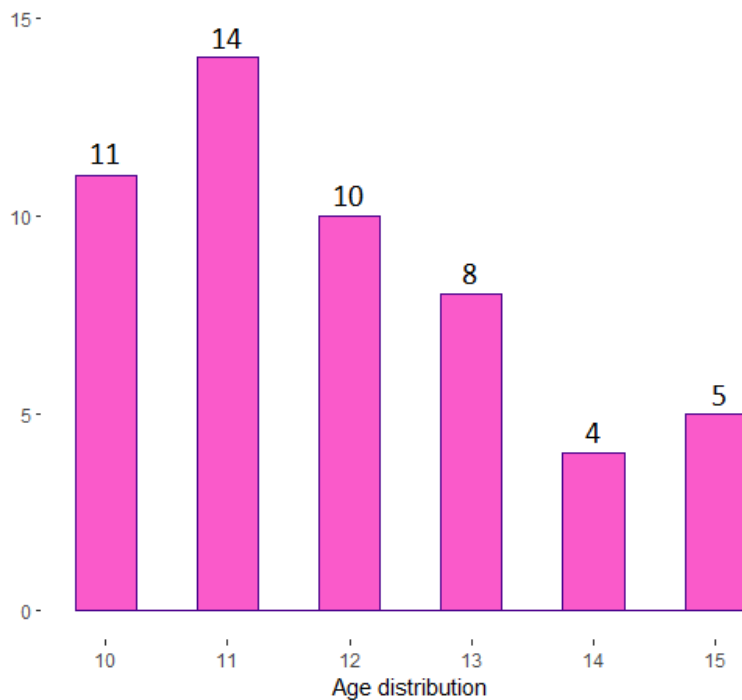
complete the FEFA-2 task. We also controlled for the participant's age in our models to account for any potential maturation effects.

### 3. RESULTS

#### 3.1. Descriptive statistics

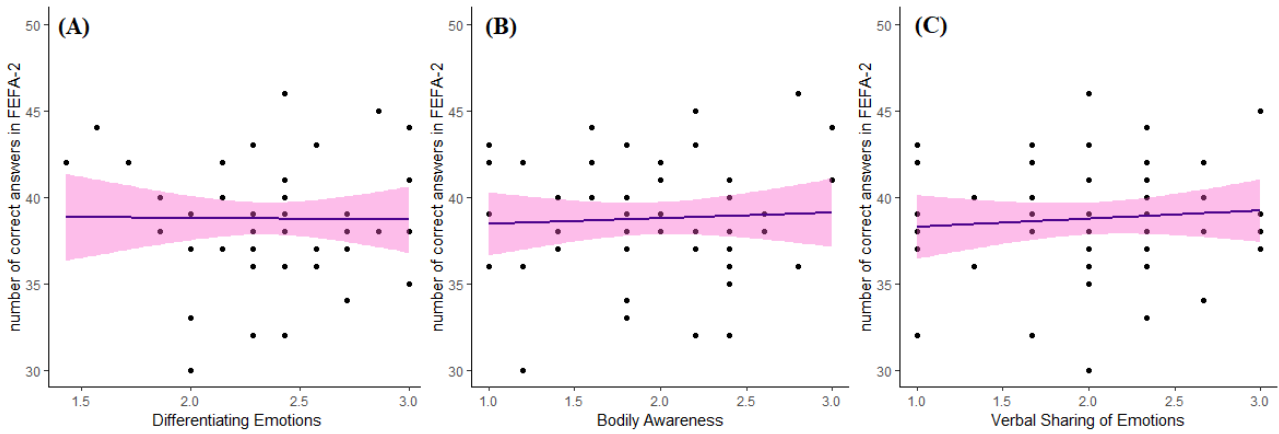
We examined each of the three EAQ factors separately. The mean score for Differentiating Emotions was 2.35 ( $SD = .37$ ), for Verbal Sharing of Emotions 2.01 ( $SD = .59$ ), and for Bodily Awareness 1.95 ( $SD = .59$ ). Out of the 50 pictures shown, the mean score for the number of correct answers in FEFA-2 was 38.75 ( $SD = 3.3$ ) and the average time spent completing the test was 249.73 seconds ( $SD = 39$  seconds). The time range was between 177 and 369 seconds. The age distribution is illustrated in Figure 1.

**Figure 1.** The distribution of the participants in each age group.



### 3.2. Accuracy in FEFA-2

**Figure 2.** Scatter plots of the relation between the EAQ factors and the number of correct FEFA-2 responses.



Note. **(A)** Scores in Differentiating Emotions and correct FEFA-2 responses; **(B)** Scores in Bodily Awareness and correct FEFA-2 responses; **(C)** Scores in Verbal Sharing of Emotions and correct FEFA-2 responses.

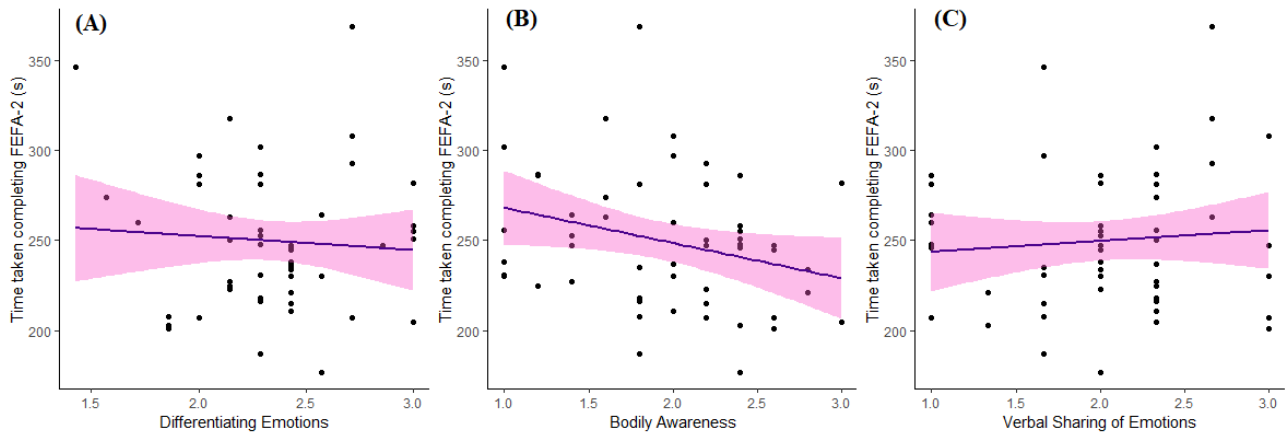
Firstly, we used Pearson correlation to investigate the nature of the relationship between the EAQ factors and the number of correct FEFA-2 responses. As shown in Figure 2, the EAQ scores did not significantly correlate with the number of correct answers in FEFA-2 in any of the three EAQ factors (Differentiating Emotions:  $r = -.01$ ,  $p = .942$ ; Bodily Awareness:  $r = .06$ ,  $p = .695$ ; Verbal Sharing of Emotions:  $r = .09$ ,  $p = .549$ ).

Secondly, we explored the predictive value of the EAQ factors on the number of correct FEFA-2 responses using linear regression. Our linear regression models included age as an independent variable to control for possible maturation effect. None of the scores of the three EAQ factors predicted the accuracy in FEFA-2 (Differentiating Emotions:  $\beta_1 = -.15$ ,  $p = .909$ ; Bodily Awareness:  $\beta_1 = .32$ ,  $p = .704$ ; Verbal Sharing of Emotions:  $\beta_1 = .67$ ,  $p = .412$ ). According to our regression models, the EAQ factors and age together did not significantly explain the variance in the number of correct FEFA-2 answers (Differentiating Emotions:  $F(2, 49) = .26$ ,  $p = .773$ , adjusted  $R^2 = -.03$ ; Bodily Awareness:  $F(2, 49) = .36$ ,  $p = .724$ , adjusted  $R^2 = -.03$ ; Verbal Sharing of Emotions:  $F(2, 49) = .60$ ,  $p = .554$ , adjusted  $R^2 = -.02$ ). Age of the participant alone did not seem to predict the performance in any of the models (Differentiating Emotions:  $\beta_1 = .21$ ,  $p = .478$ ; Bodily Awareness:  $\beta_1 = .21$ ,  $p = .484$ ; Verbal Sharing of Emotions:  $\beta_1 = .28$ ,  $p = .366$ ).



### 3.3. FEFA-2 completing speed

**Figure 3.** Scatter plots of the relation between the EAQ factors and the time spent completing FEFA-2 in seconds.



Note. **(A)** Scores in Differentiating Emotions and time spent completing FEFA-2; **(B)** Scores in Bodily Awareness and time spent completing FEFA-2; **(C)** Scores in Verbal Sharing of Emotions and time spent completing FEFA-2.

We started by using Pearson correlation to investigate the nature of the relationship between the EAQ factors and the time spent completing FEFA-2 task. The factor Bodily Awareness correlated negatively with the time spent completing the FEFA-2 ( $r = -.28$ ,  $p = .042$ ). The EAQ factors Differentiating Emotions and Verbal Sharing of Emotions did not significantly correlate with the time spent completing the FEFA-2 (Differentiating Emotions:  $r = -.07$ ,  $p = .606$ ; Verbal Sharing of Emotions:  $r = .09$ ,  $p = .522$ ).

Secondly, we examined the predictive value of the EAQ factors on the time spent completing FEFA-2 responses using linear regression. Our linear regression models included age as an independent variable to control for possible maturation effect. Bodily Awareness significantly predicted the time spent, with age being controlled in the model ( $\beta_1 = -19.34$ ,  $p = .042$ ). The scores of Differentiating Emotions and Verbal Sharing of Emotions did not predict the time spent completing the FEFA-2 task (Differentiating Emotions:  $\beta_1 = -6.54$ ,  $p = .662$ ; Verbal Sharing of Emotions:  $\beta_1 = 2.61$ ,  $p = .786$ ). In our linear regression models, Bodily Awareness and age together significantly explained about 8 % of variance in the FEFA-2 task completion time ( $F(2, 49) = 3.29$ ,  $p = .046$ ,

adjusted  $R^2 = .08$ ). The other two EAQ factors and age together did not significantly explain the variance in the time spent completing FEFA-2 task (Differentiating Emotions:  $F(2, 49) = 1.12, p = .336$ , adjusted  $R^2 = -.00$ ; Verbal Sharing of Emotions:  $F(2, 49) = 1.05, p = .357$ , adjusted  $R^2 = .00$ ). Age of the participant alone did not seem to predict the performance in any of the models (Differentiating Emotions:  $\beta_1 = -4.84, p = .168$ ; Verbal Sharing of Emotions:  $\beta_1 = -4.66, p = .201$ ; Bodily Awareness:  $\beta_1 = -4.82, p = .153$ ).

## 4. DISCUSSION

The purpose of this study was to examine if alexithymic traits predict children's ability to infer emotional states from facial expressions. Our data consisted of 52 participants between the ages of 10 and 15 and was collected at Tampere University in 2021. Alexithymia was measured with three factors of the Emotion Awareness Questionnaire (EAQ), which are Differentiating emotions, Verbal Sharing of Emotions and Bodily Awareness. The ability to recognize emotional facial expressions was assessed with the FEFA-2 facial recognition task. As our first research question, we examined if the alexithymia scores could predict the number of correct answers in the FEFA-2. As the second research question, we examined how the alexithymia scores predict the time spent completing the test. Considering our first question, our study did not find a significant connection between the alexithymia scores and the number of correct answers in the FEFA-2 task. Observing the second question, Bodily Awareness negatively correlated with the time taken to complete the FEFA-2; higher scores of the factor Bodily Awareness, indicating lower level of this ability, predicted less time spent completing the FEFA-2 task. However, this study did not find a significant connection between the factors Differentiating Emotions and Verbal Sharing of Emotions and the time taken to complete the FEFA-2 task. The findings of our study are discussed in detail in the following sections, presenting possible explanations for the results, considering the study's limitations, and proposing ideas for future research.

### 4.1. Alexithymia and facial emotion recognition

As our first research question, we investigated whether there was any connection between alexithymic traits and the number of correct answers in the facial emotion recognition task FEFA-2. Based on results of previous studies demonstrating associations between alexithymia and poorer facial emotion recognition compared to non-alexithymic people (Di Tella et al., 2020; Grynberg et al., 2012), we hypothesized that children with higher levels of alexithymic traits show poorer performance in FEFA-2, making more mistakes choosing corresponding emotions for the facial expressions shown. Here we did not find support for our hypothesis, with the alexithymic traits not correlating with or predicting the performance in FEFA-2 in any of the three EAQ factors, Differentiating Emotions, Bodily Awareness, or Verbal Sharing of Emotions.

Our second research question was if alexithymic traits have connections to the time spent completing the facial emotion recognition task FEFA-2. Based on previous studies proposing that people with higher alexithymia levels may need more time to recognize emotions from facial expressions (Ihme et al., 2014; Prkachin et al., 2009), we hypothesized that children with higher levels of alexithymia would take more time completing the FEFA-2 task. The factor Bodily Awareness significantly correlated with and predicted the time the participants spent completing the FEFA-2 task. Our study demonstrated that better bodily awareness, that is lower alexithymia, predicted a longer completion time of the FEFA-2. This contradicted our hypothesis suggesting that higher scores of alexithymia would predict a longer time in the task completion. The factors Differentiating Emotions and Verbal Sharing of Emotions did not significantly correlate or predict the time spent completing FEFA-2, thus not supporting our hypothesis.

One possible explanation for the non-significant results in both research questions could be that our sample might consist of more emotionally aware or empathetic children compared to the averages of the population, and thus resulting in less variance in the alexithymia scores. The participants were recruited via advertisements on social media platforms and mailing lists, so it is probable that the people wanting to participate in such research were already interested in themes such as emotional awareness and emotion recognition. In addition, parents with higher education or high interest in emotions might be more interested in advertisements for scientific research. Prior interest in emotions might affect the amount of emotional education the parents provide to their child, affecting the levels of alexithymic traits in these children. To conclude, the family backgrounds of the participating children might influence the properties of the sample.

On the other hand, our EAQ scores seem to be similar to the mean scores in a study consisting of a larger sample of children from The Netherlands, Belgium and Spain, with a slightly larger difference in Bodily Awareness (Differentiating Emotions:  $M = 2.34$ ,  $SD = .41$ ; Verbal Sharing of Emotions:  $M = 2.05$ ,  $SD = .59$ ; Bodily Awareness:  $M = 1.89$ ,  $SD = .52$ ; Lahaye et al., 2011). This

suggests that alexithymic traits in our sample are on average the same as in children in other countries, but our smaller sample compared to the international study might not show the variance of the alexithymic traits that are present in Finnish population. In addition to this, our sample consisted of healthy children who were not known to have high levels of alexithymia. With alexithymia being a normally distributed trait, the probability of significantly high alexithymia scores appearing in our small, non-randomly selected sample is low. This caused the alexithymia scores to be quite low and further kept the variance of the alexithymia scores rather small, which can affect the results of the research.

It is worth noting, that Parker et al. (2005) and Prkachin et al. (2009) found that when given plenty of time, the people with high alexithymia scores perform at a similar level in the facial emotion recognition task compared to the people with low alexithymia scores. In our study, the time to view the facial expression stimulus was not limited, which helps explain the lack of significant results in the first research question.

One possible explanation for participants with good bodily awareness spending more time in FEFA-2 could be that these participants may consider and rethink their answers for a longer time. This would suggest that people with lower levels of bodily awareness may go through the FEFA-2 task faster if they do not know the answer or do not have much interest in the task. Consequently, children with more interest in the task, and hence most likely in themes of emotions, may have more motivation in the research and so want to do the FEFA-2 task thoroughly.

The result of the connection between bodily awareness and the time taken to complete the facial emotion recognition task differed from the results for the other two alexithymia factors. Bodily awareness, the ability to listen to bodily cues and to notice changes in the bodily states, might be more strongly affected by innate characteristics, with some people naturally giving more attention to bodily sensations, whereas the factors assessing the ability to differentiate emotions and to verbally share emotions could be more teachable skills, being more strongly connected to, for example, the language used to talk about emotions. These differences in the three aspects of alexithymia could help explain the variation in the results within the alexithymia concept.

The age of the participant did not seem to have a predictive value in the number of correct answers or the completion speed of FEFA-2. The emotion recognition abilities have been demonstrated to be somewhat stable by the age of 10-11 years (Tonks et al., 2007). We suggest that this is why there appear to be no significant differences in completing FEFA-2 at different ages in our sample.

## 4.2. Strengths and limitations

The key strength of our study was that it introduced a new viewpoint to the research of alexithymia and facial emotion recognition. The connections between alexithymia and facial emotion recognition have not been studied in children before. Children are still developing their emotional abilities and navigating complex social relationships, especially peer groups in school environment. Emotion recognition is important in interpersonal interactions (Laamanen et al., 2022), and therefore it is essential to understand how awareness of one's emotions impacts facial emotion recognition. Additionally, this study was the first to examine these connections in a Finnish sample, contributing to our understanding of cultural impacts on the research topic. As mentioned earlier, culture affects the way people express their emotions, and how people interpret others' facial expressions (Ekman, 1992; Jack et al., 2009). Therefore, studying these topics in different cultural contexts is valuable and provides more knowledge on emotional abilities.

Some limitations in our study are the rather small sample size of 52 participants and the lack of significantly high alexithymia scores, resulting in small variance in the alexithymic traits in the sample. The participants were recruited via advertisements and mailing lists, and therefore the sample might consist of children whose parents are more interested in themes of emotions. Because we did not have significantly high alexithymia scores, we could not divide the participants into groups of alexithymic and non-alexithymic children and make direct comparisons between these groups. Additionally, the age distribution of our sample was slightly unbalanced with more participants at the younger end of our age range. These issues create limitations on drawing conclusions from the results. However, the gender distribution in our sample can be seen as a strength; 53.8 % of the participants were female and 46.2 % were male.

The Emotion Awareness Questionnaire (EAQ) is a questionnaire with relatively good reliability, with Cronbach's alpha of .74 for the three factors used in this study, and hence seems to be suitable for measuring emotion awareness and alexithymia in children. However, it is also necessary to consider that the EAQ used in our study is a self-assessment tool. Self-assessment is perhaps not always trustworthy, even when testing adults, and Rieffe et al. (2006) considered this while developing the alexithymia questionnaire for children. They stated that one limitation of their study was the use of self-reports only. Therefore, it is important to note that children of different ages may evaluate their own emotional abilities differently; a 10-year-old participant may have different

capabilities to assess their emotional awareness compared to a 15-year-old participant. This is not necessarily a limitation of our study, but a matter to consider when interpreting the results.

Finally, we lacked background information about the families of the children, such as the education level of the parents or other socio-economic factors, so we could not control for the potential mediation of those factors. Socio-economic factors, such as parents' education level, play a role in children's lives, for example mental (Assari, 2018; Davis et al., 2010) and physical health (Fadel et al., 2022; Poulain et al., 2019), so taking such factors into account when studying children is necessary. Additionally, education seems to be a protective factor for mental health, for example, through emotional abilities (Hahn & Truman, 2015). There has been demonstrated a connection between the parents' and their children's emotional abilities, such as alexithymia (López et al., 2018), and this connection could happen through upbringing. Higher education might also increase the appreciation of children's emotional education. Thus, it is possible that parents' education affects the level of the child's alexithymia and further life outcomes in these ways.

#### **4.3. Ideas for further research**

In the future, a larger sample could bring more variance to the alexithymia scores. In addition, studying this topic in an experimental research frame by having separate groups for higher and lower alexithymia scores would enable comparisons between those groups. It could be beneficial to recruit participants who have experienced challenges with emotional awareness in settings such as healthcare or education. This could enable studying these same questions with individuals who have significant levels of alexithymia and, hence, provide more knowledge about how difficulties in identifying and describing emotions impact individuals' lives.

In our study, we used only three factors of the Emotion Awareness Questionnaire (EAQ) that related to alexithymia; Differentiating Emotions, Verbal Sharing of Emotions and Bodily Awareness. Considering future research, it could be interesting to use the whole EAQ, studying emotion awareness as a broader concept and its connections to facial emotion recognition. Alexithymia is closely related to other emotional abilities and is a part of emotion awareness. Utilizing the EAQ as a whole, including the three other factors of the EAQ, Acting Out Emotions, Analyses of Emotions and Other's Emotions, may bring new perspectives to facial emotion recognition.

The connections between alexithymia and recognition of others' emotions could be studied in more diverse ways in future. Watching people in motion instead of looking at pictures of faces could

bring out different viewpoints on emotion recognition in alexithymia by creating a more realistic research setting. It is also essential to consider that facial expressions are only one means to express emotions, and it has been demonstrated that viewing facial expressions in isolation and without contextual cues might not be sufficient for inferring emotional states (Barrett & Kensinger, 2010). Emotions are expressed in various ways, including bodily movements and tone of voice, and researching these aspects could provide more versatile knowledge of emotion recognition. This diverse recognition of others' emotions and their connections to alexithymia could be studied, for instance, by showing the participants videos of people expressing emotions or by utilizing virtual reality devices. Overall, further research on alexithymia and emotion awareness could provide more understanding of the connections between emotional abilities, recognition of others' emotions, and their impact on individuals' lives.

#### **4.4. Conclusions**

According to our study, alexithymic traits do not seem to correlate with or predict facial emotion recognition abilities. The only significant result was that lower bodily awareness predicts less time spent on the facial emotion recognition task. These results, however, must be interpreted with caution since our study had limitations, such as small sample size, possibly leading to less variance in the EAQ scores. More research on this topic needs to be done to draw conclusions. A lot of previous research on similar topics with adult samples has shown significant connections between alexithymia and facial emotion recognition. Hence, it is probable that alexithymia has some connections to children's emotional abilities, that did not arise in our study and research setting.

This study was to our knowledge the first to research the connections between alexithymic traits and facial emotion recognition both in a sample of children and in a sample of Finnish participants. Thus, our study paved the way for future research on these topics. Our results evoked new questions about children's alexithymia and facial emotion recognition, such as the significance of socio-economic factors and the use of clinical samples of alexithymic people in the study of alexithymia and emotion recognition abilities.

If alexithymia is understood and recognized more, for instance, by healthcare professionals, interventions aiming to improve one's emotional abilities can be provided specifically for the individuals who may benefit from them. As for now, socio-emotional deficits are often seen as a

characteristic trait of ASD, when these deficits could actually be caused by co-occurring alexithymia, which has been demonstrated to be more common in autistic people compared to people with no autism (Griffin et al., 2016; Shah et al., 2016). There is a possibility that non-autistic people with alexithymia might not get the help they need if the interventions for improving emotional abilities are, for example, only offered to people with ASD diagnosis. Healthcare and school environments have significant roles in children's development. Understanding alexithymia and its impacts on emotional abilities could enable better support for children by both healthcare professionals and school staff.



## REFERENCES

- American Psychological Association. (n.d.). Emotion. In *APA dictionary of psychology*. Retrieved February 21, 2023, from <https://dictionary.apa.org/emotion>
- Assari, S. (2018). Parental educational attainment and mental well-being of college students: Diminished returns of blacks. *Brain Sciences*, 8(11), 193. <https://doi.org/10.3390/brainsci8110193>
- Bagby, R. M., Parker, J. D. A., & Taylor, G. J. (1994). The twenty-item Toronto Alexithymia scale—I. Item selection and cross-validation of the factor structure. *Journal of Psychosomatic Research*, 38(1), 23–32. [https://doi.org/10.1016/0022-3999\(94\)90005-1](https://doi.org/10.1016/0022-3999(94)90005-1)
- Barrett, L. F. (2006). Are emotions natural kinds? *Perspectives on Psychological Science*, 1(1), 28–58. <https://doi.org/10.1111/j.1745-6916.2006.00003.x>
- Barrett, L. F., & Kensinger, E. A. (2010). Context is routinely encoded during emotion perception. *Psychological Science*, 21(4), 595–599. <https://doi.org/10.1177/0956797610363547>
- Bornhofen, C., & McDonald, S. (2008). Emotion perception deficits following traumatic brain injury: A review of the evidence and rationale for intervention. *Journal of the International Neuropsychological Society*, 14(4), 511–525. <https://doi.org/10.1017/S1355617708080703>
- Bölte, S., Feineis-Matthews, S., Leber, S., Dierks, T., Hubl, D., & Poustka, F. (2002). The development and evaluation of a computer-based program to test and to teach the recognition of facial affect. *International Journal of Circumpolar Health*, 61(2), 61–68. <https://doi.org/10.3402/ijch.v61i0.17503>
- Chester, M., Plate, R. C., Powell, T., Rodriguez, Y., Wagner, N. J., & Waller, R. (2023). The COVID-19 pandemic, mask-wearing, and emotion recognition during late-childhood. *Social Development*, 32(1), 315–328. <https://doi.org/10.1111/sode.12631>
- Chronaki, G., Hadwin, J. A., Garner, M., Muraige, P., & Sonuga-Barke, E. J. S. (2015). The development of emotion recognition from facial expressions and non-linguistic vocalizations during childhood. *British Journal of Developmental Psychology*, 33(2), 218–236. <https://doi.org/10.1111/bjdp.12075>
- Dalili, M. N., Penton-Voak, I. S., Harmer, C. J., & Munafò, M. R. (2015). Meta-analysis of emotion recognition deficits in major depressive disorder. *Psychological Medicine*, 45(6), 1135–1144. <https://doi.org/10.1017/S0033291714002591>

- Davis, E., Sawyer, M. G., Lo, S. K., Priest, N., & Wake, M. (2010). Socioeconomic risk factors for mental health problems in 4-5-year-old children: Australian population study. *Academic Pediatrics*, 10(1), 41–47. <https://doi.org/10.1016/j.acap.2009.08.007>
- Di Tella, M., Adenzato, M., Catmur, C., Miti, F., Castelli, L., & Ardito, R. B. (2020). The role of alexithymia in social cognition: Evidence from a non-clinical population. *Journal of Affective Disorders*, 273, 482–492. <https://doi.org/10.1016/j.jad.2020.05.012>
- Ekman, P. (1992). Facial expressions of emotions: New findings, new questions. *Psychological Science*, 3(1), 34–38. <https://doi.org/10.1111/j.1467-9280.1992.tb00253.x>
- Ekman, P., & Friesen, W. V. (1971). Constants across cultures in the face and emotion. *Journal of Personality & Social Psychology*, 17(2), 124–129.
- Fadel, H. T., Alamray, S. F., Alsayed, S. S., Zolaly, G. Y., Alsisi, L. H., & Bahammam, S. A. (2022). Parents' education level and children's BMI explain caries distribution among kindergarten students: A cross-sectional study. *Eastern Mediterranean Health Journal*, 28(3), 190–196. <https://doi.org/10.26719/emhj.21.074>
- Franz, M., Popp, K., Schaefer, R., Sitte, W., Schneider, C., Hardt, J., Decker, O., & Braehler, E. (2008). Alexithymia in the German general population. *Social Psychiatry and Psychiatric Epidemiology*, 43(1), 54–62. <https://doi.org/10.1007/s00127-007-0265-1>
- Frith, C. D., & Frith, U. (2007). Social cognition in humans. *Current Biology*, 17(16), R724–R732. <https://doi.org/10.1016/j.cub.2007.05.068>
- Fujiwara, E. (2018). Looking at the eyes interferes with facial emotion recognition in alexithymia. *Journal of Abnormal Psychology*, 127(6), 571–577. <https://doi.org/10.1037/abn0000361>
- Gramaglia, C., Ressico, F., Gambaro, E., Palazzolo, A., Mazzarino, M., Bert, F., Siliquini, R., & Zeppegno, P. (2016). Alexithymia, empathy, emotion identification and social inference in anorexia nervosa: A case-control study. *Eating Behaviors*, 22, 46–50. <https://doi.org/10.1016/j.eatbeh.2016.03.028>
- Griffin, C., Lombardo, M. V., & Auyeung, B. (2016). Alexithymia in children with and without autism spectrum disorders. *Autism Research*, 9(7), 773–780. <https://doi.org/10.1002/aur.1569>
- Grynberg, D., Chang, B., Corneille, O., Maurage, P., Vermeulen, N., Berthoz, S., & Luminet, O. (2012). Alexithymia and the processing of emotional facial expressions (EFEs): Systematic review, unanswered questions and further perspectives. *PLoS One*, 7(8), e42429. <https://doi.org/10.1371/journal.pone.0042429>
- Grynszpan, O., Weiss, P. L. (Tamar), Perez-Diaz, F., & Gal, E. (2014). Innovative technology-based interventions for autism spectrum disorders: A meta-analysis. *Autism*, 18(4), 346–361. <https://doi.org/10.1177/1362361313476767>

- Hahn, R. A., & Truman, B. I. (2015). Education improves public health and promotes health equity. *International Journal of Health Services*, 45(4), 657–678.  
<https://doi.org/10.1177/00207314155585986>
- Hampson, E., van Anders, S. M., & Mullin, L. I. (2006). A female advantage in the recognition of emotional facial expressions: Test of an evolutionary hypothesis. *Evolution and Human Behavior*, 27(6), 401–416. <https://doi.org/10.1016/j.evolhumbehav.2006.05.002>
- Humphreys, T. P., Wood, L. M., & Parker, J. D. A. (2009). Alexithymia and satisfaction in intimate relationships. *Personality and Individual Differences*, 46(1), 43–47.  
<https://doi.org/10.1016/j.paid.2008.09.002>
- Iannattone, S., Miscioscia, M., Raffagnato, A., & Gatta, M. (2021). The role of alexithymia in social withdrawal during adolescence: A case–control study. *Children*, 8(2), 165.  
<https://doi.org/10.3390/children8020165>
- Ihme, K., Sacher, J., Lichev, V., Rosenberg, N., Kugel, H., Rufer, M., Grabe, H.-J., Pampel, A., Lepsien, J., Kersting, A., Villringer, A., Lane, R. D., & Suslow, T. (2014). Alexithymic features and the labeling of brief emotional facial expressions – An fMRI study. *Neuropsychologia*, 64, 289–299. <https://doi.org/10.1016/j.neuropsychologia.2014.09.044>
- Jack, R. E., Blais, C., Scheepers, C., Schyns, P. G., & Caldara, R. (2009). Cultural confusions show that facial expressions are not universal. *Current Biology*, 19(18), 1543–1548.  
<https://doi.org/10.1016/j.cub.2009.07.051>
- Jack, R. E., Garrod, O. G. B., Yu, H., Caldara, R., & Schyns, P. G. (2012). Facial expressions of emotion are not culturally universal. *Proceedings of the National Academy of Sciences*, 109(19), 7241–7244. <https://doi.org/10.1073/pnas.1200155109>
- Joukamaa, M., Luutonen, S., Reventlow, H. von, Karlsson, P. P. H., & Salokangas, R. K. R. (2008). Alexithymia and childhood abuse among patients attending primary and psychiatric care: Results of the RADEP study. *Psychosomatics*, 49(4), 317–325.
- Kafetsios, K., & Hess, U. (2019). Seeing mixed emotions: Alexithymia, emotion perception bias, and quality in dyadic interactions. *Personality and Individual Differences*, 137, 80–85.  
<https://doi.org/10.1016/j.paid.2018.08.014>
- Karolinska Institutet. (n.d.). *FEFA 2—A computer based program for the training and testing of facial affect recognition*. Retrieved February 22, 2023, from <https://ki.se/en/kind/fe-fa-2-a-computer-based-program-for-the-training-and-testing-of-facial-affect-recognition>
- Kohler, C. G., Hoffman, L. J., Eastman, L. B., Healey, K., & Moberg, P. J. (2011). Facial emotion perception in depression and bipolar disorder: A quantitative review. *Psychiatry Research*, 188(3), 303–309. <https://doi.org/10.1016/j.psychres.2011.04.019>

- Kohler, C. G., Walker, J. B., Martin, E. A., Healey, K. M., & Moberg, P. J. (2010). Facial emotion perception in schizophrenia: A meta-analytic review. *Schizophrenia Bulletin*, 36(5), 1009–1019. <https://doi.org/10.1093/schbul/sbn192>
- Laamanen, P., Kiuru, N., Flykt, M., Vänskä, M., Hietanen, J. K., Peltola, M. J., Kurkela, E., Poikkeus, P., Tiitinen, A., & Lindblom, J. (2022). How do early family systems predict emotion recognition in middle childhood? *Social Development*, 31(1), 196–211. <https://doi.org/10.1111/sode.12526>
- Lahaye, M., Mikolajczak, M., Rieffe, C., Villanueva, L., Van Broeck, N., Bodart, E., & Luminet, O. (2011). Cross-validation of the emotion awareness questionnaire for children in three populations. *Journal of Psychoeducational Assessment*, 29(5), 418–427. <https://doi.org/10.1177/0734282910390013>
- Leppänen, J. M. (2011). Neural and developmental bases of the ability to recognize social signals of emotions. *Emotion Review*, 3(2), 179–188. <https://doi.org/10.1177/1754073910387942>
- Levant, R. F. (1992). Toward the reconstruction of masculinity. *Journal of Family Psychology*, 5(3–4), 379–402. <https://doi.org/10.1037/0893-3200.5.3-4.379>
- Levant, R. F., Hall, R. J., Williams, C. M., & Hasan, N. T. (2009). Gender differences in alexithymia. *Psychology of Men & Masculinity*, 10(3), 190–203. <https://doi.org/10.1037/a0015652>
- Leweke, F., Leichsenring, F., Kruse, J., & Hermes, S. (2011). Is alexithymia associated with specific mental disorders? *Psychopathology*, 45(1), 22–28. <https://doi.org/10.1159/000325170>
- López, E. C., Peñacoba Puente, C., & Benito Moreno, S. (2018). Is there any relation between alexithymia in parents and children? Effects on children's quality of life. *Electronic Journal of Research in Educational Psychology*, 16(44), 103–126. <https://doi.org/10.25115/ejrep.v16i44.1939>
- Martinez-Sanchez, F., Fernández-Abascal, E. G., & Sánchez-Pérez, N. (2017). Recognition of emotional facial expressions in alexithymia. *Studia Psychologica*, 59(3), 206–216. <https://doi.org/10.21909/sp.2017.03.741>
- Mattila, A. K., Saarni, S. I., Salminen, J. K., Huhtala, H., Sintonen, H., & Joukamaa, M. (2009). Alexithymia and health-related quality of life in a general population. *Psychosomatics*, 50(1), 59–68.
- Nesse, R. M., & Ellsworth, P. C. (2009). Evolution, emotions, and emotional disorders. *American Psychologist*, 64(2), 129–139. <https://doi.org/10.1037/a0013503>
- Nicolò, G., Semerari, A., Lysaker, P. H., Dimaggio, G., Conti, L., D'Angerio, S., Procacci, M., Popolo, R., & Carcione, A. (2011). Alexithymia in personality disorders: Correlations with

- symptoms and interpersonal functioning. *Psychiatry Research*, 190(1), 37–42.  
<https://doi.org/10.1016/j.psychres.2010.07.046>
- Parker, P. D., Prkachin, K. M., & Prkachin, G. C. (2005). Processing of facial expressions of negative emotion in alexithymia: The influence of temporal constraint. *Journal of Personality*, 73(4), 1087–1107. <https://doi.org/10.1111/j.1467-6494.2005.00339.x>
- Picardi, A., Fagnani, C., Gigantesco, A., Toccaceli, V., Lega, I., & Stazi, M. A. (2011). Genetic influences on alexithymia and their relationship with depressive symptoms. *Journal of Psychosomatic Research*, 71(4), 256–263. <https://doi.org/10.1016/j.jpsychores.2011.02.016>
- Poulain, T., Vogel, M., Sobek, C., Hilbert, A., Körner, A., & Kiess, W. (2019). Associations between socio-economic status and child health: Findings of a large German cohort study. *International Journal of Environmental Research and Public Health*, 16(5), 677.  
<https://doi.org/10.3390/ijerph16050677>
- Preece, D. A., Mehta, A., Petrova, K., Sikka, P., Bjureberg, J., Becerra, R., & Gross, J. J. (2023). Alexithymia and emotion regulation. *Journal of Affective Disorders*, 324, 232–238.  
<https://doi.org/10.1016/j.jad.2022.12.065>
- Prillinger, K., Radev, S. T., Amador de Lara, G., Klöbl, M., Lanzenberger, R., Plener, P. L., Poustka, L., & Konicar, L. (2021). Repeated sessions of transcranial direct current stimulation on adolescents with autism spectrum disorder: Study protocol for a randomized, double-blind, and sham-controlled clinical trial. *Frontiers in Psychiatry*, 12.  
<https://www.frontiersin.org/articles/10.3389/fpsyt.2021.680525>
- Prkachin, G. C., Casey, C., & Prkachin, K. M. (2009). Alexithymia and perception of facial expressions of emotion. *Personality and Individual Differences*, 46(4), 412–417.  
<https://doi.org/10.1016/j.paid.2008.11.010>
- R Core Team (2021). R: A language and environment for statistical computing. R Foundation for Statistical Computing, Vienna, Austria. <https://www.R-project.org/>
- Revelle, W. (2022). psych: Procedures for Personality and Psychological Research, Northwestern University, Evanston, Illinois, USA. Version 2.2.9. <https://CRAN.R-project.org/package=psych>
- Rieffe, C., Oosterveld, P., & Terwogt, M. M. (2006). An alexithymia questionnaire for children: Factorial and concurrent validation results. *Personality and Individual Differences*, 40(1), 123–133. <https://doi.org/10.1016/j.paid.2005.05.013>
- Rieffe, C., Terwogt, M. M., Petrides, K. V., Cowan, R., Miers, A. C., & Tolland, A. (2007). Psychometric properties of the Emotion Awareness Questionnaire for children. *Personality and Individual Differences*, 43(1), 95–105. <https://doi.org/10.1016/j.paid.2006.11.015>

- Rudis, B. (2020). hrbrthemes: Additional Themes, Theme Components and Utilities for 'ggplot2'. Version 0.8.0. <https://CRAN.R-project.org/package=hrbrthemes>
- Saure, E., Raevuori, A., Laasonen, M., & Lepistö-Paisley, T. (2022). Emotion recognition, alexithymia, empathy, and emotion regulation in women with anorexia nervosa. *Eating and Weight Disorders - Studies on Anorexia, Bulimia and Obesity*, 27(8), 3587–3597. <https://doi.org/10.1007/s40519-022-01496-2>
- Sawada, R., Sato, W., Kochiyama, T., Uono, S., Kubota, Y., Yoshimura, S., & Toichi, M. (2014). Sex differences in the rapid detection of emotional facial expressions. *PLoS ONE*, 9(4), e94747. <https://doi.org/10.1371/journal.pone.0094747>
- Scheerer, N. E., Boucher, T. Q., & Iarocci, G. (2021). Alexithymia is related to poor social competence in autistic and nonautistic children. *Autism Research*, 14(6), 1252–1259. <https://doi.org/10.1002/aur.2485>
- Shah, P., Hall, R., Catmur, C., & Bird, G. (2016). Alexithymia, not autism, is associated with impaired interoception. *Cortex*, 81, 215–220. <https://doi.org/10.1016/j.cortex.2016.03.021>
- Shank, L. M., Tanofsky-Kraff, M., Kelly, N. R., Jaramillo, M., Rubin, S. G., Altman, D. R., Byrne, M. E., LeMay-Russell, S., Schvey, N. A., Broadney, M. M., Brady, S. M., Yang, S. B., Courville, A. B., Ramirez, S., Crist, A. C., Yanovski, S. Z., & Yanovski, J. A. (2019). The association between alexithymia and eating behavior in children and adolescents. *Appetite*, 142, 104381. <https://doi.org/10.1016/j.appet.2019.104381>
- Sifneos, P. E. (1973). The prevalence of “alexithymic” characteristics in psychosomatic patients. *Psychotherapy and Psychosomatics*, 22(2/6), 255–262.
- Steele, H., Steele, M., & Croft, C. (2008). Early attachment predicts emotion recognition at 6 and 11 years old. *Attachment & Human Development*, 10(4), 379–393. <https://doi.org/10.1080/14616730802461409>
- Swart, M., Kortekaas, R., & Aleman, A. (2009). Dealing with feelings: Characterization of trait alexithymia on emotion regulation strategies and cognitive-emotional processing. *PLoS ONE*, 4(6), 1–7. <https://doi.org/10.1371/journal.pone.0005751>
- Tonks, J., Williams, W. H., Frampton, I., Yates, P., & Slater, A. (2007). Assessing emotion recognition in 9–15-years olds: Preliminary analysis of abilities in reading emotion from faces, voices and eyes. *Brain Injury*, 21(6), 623–629. <https://doi.org/10.1080/02699050701426865>
- Tooby, J. & Cosmides, L. (2008). The evolutionary psychology of the emotions and their relationship to internal regulatory variables. In M. Lewis, J. M. Haviland-Jones & L. F. Barrett (Eds.), *Handbook of Emotions* (3<sup>rd</sup> Ed., pp. 114–137). Guilford.

- Vassallo, S., Cooper, S. L., & Douglas, J. M. (2009). Visual scanning in the recognition of facial affect: Is there an observer sex difference? *Journal of Vision*, 9(3), 11.  
<https://doi.org/10.1167/9.3.11>
- Way, I. F., Applegate, B., Cai, X., Franck, L. K., Black-Pond, C., Yelsma, P., Roberts, E., Hyter, Y., & Muliatt, M. (2010). Children's Alexithymia Measure (CAM): A new instrument for screening difficulties with emotional expression. *Journal of Child & Adolescent Trauma*, 3(4), 303–318. <https://doi.org/10.1080/19361521.2010.523778>
- Wickham, H. (2016). *ggplot2: Elegant Graphics for Data Analysis*. Springer-Verlag, New York.
- Wingenbach, T. S. H., Ashwin, C., & Brosnan, M. (2018). Sex differences in facial emotion recognition across varying expression intensity levels from videos. *PLoS ONE*, 13(1), e0190634. <https://doi.org/10.1371/journal.pone.0190634>

## APPENDIX

### Aleksitymiakysely, Emotion Awareness Questionnaire; EAQ-30; Rieffe et al. 2007

Alla on 30 lyhyttä lausetta. Jokainen lause on kuvaus siitä, mitä voit tuntea tai ajatella tunteistasi. Valitse jokaisen lauseen kohdalla, kuinka hyvin se pitää paikkaansa sinun kohdallasi. Valitse parhaiten itseäsi kuvaava vastaus. Voit valita vain yhden vastauksen. Jos vastaaminen tuntuu vaikealta, valitse vastaus, joka kuvaa sinua yleensä. Eri ihmisillä on erilaisia tunteita ja ajatuksia tunteistaan. Siksi kysymyksiin ei ole olemassa oikeita tai vääriä vastauksia, vaan ne kuvaavat vain sitä, mitä juuri sinä ajattelet.

Esimerkiksi lause voisi olla:

"Kun olen poissa tolaltani, yritän unohtaa sen."

Jos tämä lause pitää paikkaansa sinun kohdallasi, merkitse "kuvaa minua hyvin".

Jos tämä lause pitää joskus paikkaansa sinun kohdallasi, merkitse "kuvaa minua joskus".

Jos tämä lause ei pidä koskaan paikkaansa sinun kohdallasi, merkitse "ei kuvaa minua".

1. Olen usein ymmälläni tai ihmeissäni siitä, mitä tunnen.
2. Minun on vaikea selittää ystävälle, mitä tunnen.
3. Toisten ihmisten ei tarvitse tietää, mitä tunnen.
4. Kun olen peloissani tai hermostunut, tunnen jotain vatsassani.
5. Minulle on tärkeää tietää, mitä ystäväni tuntevat.
6. Kun olen vihainen tai poissa tolaltani, yritän ymmärtää miksi.
7. On vaikea tietää, tunnenko surua vai vihaa vai jotakin muuta.
8. Minusta on vaikeaa kertoa muille, mitä tunnen.
9. Kun olen jostain syystä poissa tolaltani, en yleensä kerro siitä muille.
10. Kun olen poissa tolaltani, tunnen sen myös kehossani.
11. En halua tietää, mitä ystäväni tuntevat.
12. Tunteeni auttavat minua ymmärtämään, mitä on tapahtunut.
13. En koskaan täysin tiedä, mikä tunne minulla on.
14. Voin helposti selittää ystävälle, mitä tunnen sisimmässäni.
15. Kun olen vihainen tai poissa tolaltani, yritän piilottaa sen.
16. En tunne mitään kehossani, kun olen peloissani tai hermostunut.
17. Kun ystävä on poissa tolaltaan, yritän ymmärtää miksi.
18. Kun minulla on ongelma, minua auttaa kun tiedän miltä se minusta tuntuu.
19. Kun olen poissa tolaltani, en tiedä olenko surullinen, peloissani vai vihainen.
20. Kun olen poissa tolaltani, yritän olla näyttämättä sitä.
21. Kehoni tuntuu erilaiselta, kun olen poissa tolaltani.
22. En välitä siitä, miltä ystävästäni tuntuu sisimmässään.
23. On tärkeää ymmärtää, mitä tunnen.
24. Joskus olen poissa tolaltani enkä ymmärrä miksi.
25. Kun minusta tuntuu pahalta, se ei kuulu kenellekään muulle.
26. Kun olen surullinen, kehoni tuntuu heikolta.
27. Tiedän yleensä, mitä ystäväni tuntevat.
28. Haluan aina tietää, miksi jokin tuntuu minusta pahalta.
29. En useinkaan tiedä, miksi olen vihainen.
30. En tiedä, milloin jokin saa minut pois tolaltani.