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# **The Alexithymia Construct and Mental Health in Everyday life: A sample study of Swedish older adolescents**

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**Abstract**

Alexithymia is related to low awareness of emotion and its associations with a wide variety of psychopathologies and mental health problems are well-documented. Despite its clinical importance, it is still largely unknown what difficulties arising from alexithymia are experienced in everyday life in non-clinical populations. This study examined a) common and differential relationships between facial affect recognition, mood regulation strategies, locus of control, autism phenotype, media use and alexithymia b) whether factors contributing to mental health problems in general are captured in the Toronto Alexithymia Scale - 20 (TAS-20) test. The study sample involved one hundred and fifty- eight 18- to 19-year-old students from secondary high schools in south-eastern Sweden. The following measures were used: Toronto Alexithymia Scale – 20, Brief Locus of Control Scale, Reading the Mind in the Eyes Test, Brief Music in Mood Regulation scale, The Broad Autism Phenotype Questionnaire and questions on media use. Correlations between the predictors and the total and subscale scores of the Toronto Alexithymia Scale-20 (TAS-20) were analysed through correlation and regression analyses. About one-third of the participants obtained scores for high alexithymia and a significant difference was observed between the two genders with women obtaining higher scores on the total scale and two of the three subscales. The results from this sample investigation in a non-clinical population indicate that internal and external loci of control represent relevant negative, respectively positive, predictors for alexithymia as measured by the Toronto Alexithymia Scale –20 (TAS-20).

**Key words:** Emotional regulation, Alexithymia, Toronto Alexithymia Scale – 20, Locus of control, Facial affect recognition, Mood regulation strategies, Autism phenotype, Media use

Being able to successfully regulate one's own emotions can be seen as essential for mental well-being, as well as for other areas in life such as physical health, relationships, academic and career outcomes (MacNamara et al., 2023). Difficulties with emotional regulation are often discussed from the viewpoint of outward acting behaviour such as aggression and violence. However, a reduced ability to regulate experienced emotions can also lead to maladaptive strategies being internally directed, leading to poor mental health. There have been reports of an increase in both certain types of aggression and violence as well as an increase in mental health problems and diagnoses of various disorders among the young population in our society (Helander et al., 2024). In research from the last decades, research have associated psychopathologies that now feature in recent reports on children's and young people's mental health, such as anxiety and depression, eating disorders and substance use, with alexithymia (e.g. Bagby et al., 2020; Lyvers et al., 2020).

The term alexithymia, literally meaning a lack of words for emotions, stems from the field of psychosomatics and was reported as a link between a person's physical body complaints and a restricted ability to verbally or symbolically discuss and identify their emotions (Hemming et al., 2019). Alexithymia feature in the literature as a strong transdiagnostic risk factor for psychopathologies (Preece et al., 2023) and can be considered a dimensional personality trait (e.g. Zhang et al., 2023) as well as having both a cognitive and affective dimension (e.g. van der Velde et al., 2015). The main areas of difficulties, as identified in the most used measure of alexithymia, the Toronto Alexithymia Scale-20 (TAS-20), are difficulties identifying feelings (DIF), difficulties describing feelings (DDF) and externally oriented thinking (EOT). However, classifications including five areas are also used, adding; a reduction in experiencing emotions as well as low capacity for symbolic thought or fantasising, to the difficulties associated with alexithymia (Hemming et al., 2019). Although Bagby et al. (2020) designed the TAS-20 to be analysed as a total, many studies also analyse the results of the subscales separately. Throughout the years, the TAS-20 has been found to correlate significantly and negatively with; openness in the five-factor model of personality; using affects to guide communication; emotional awareness; trait emotional intelligence; cognitive empathy and perspective-taking (Bagby et al., 2020). In a general population the prevalence of alexithymia is considered to be around 10-13 % and to exist on a continuum (Hemming et al., 2019).

The literature points to correlations between alexithymia and a variety of disorders and other conditions. Alexithymia as assessed by the TAS-20 has been strongly associated with eating disorders, substance use, depression, autism spectrum disorder, schizophrenia and chronic pain conditions (Westwood et al., 2017; Kinnaird, 2019; Li et al., 2015; Lyvers et al., 2020; Bagby et al., 2020; Aaron et al., 2019). In a systematic review and meta-analysis, Westwood et al. (2017), found that participants from across different clinical eating disorder groups, Anorexia Nervosa, Bulimia Nervosa and Binge Eating Disorder, scored significantly higher on the TAS-20, with medium or large effect sizes between the clinical group and healthy controls. It has also been identified as a mediator between childhood neglect and eating disorders for both men and women (Minnich et al., 2017). Alexithymia as assessed by TAS-20, and especially the subscales DIF and DDF, has been found to be closely related to self-reported depression (Li et al., 2015) and in a systematic review, Bordalo et al. (2022) found alexithymia to be a significant risk factor for non-suicidal self-harming in adolescents with depression. Substance use, of both alcohol and illicit drugs, have been identified as being strongly associated with alexithymia, mostly subscales DIF and DDF, especially in clinical patient populations and in studies with mostly males (Honkalampi et al., 2022). Alexithymia as assessed by TAS-20 has been identified as a longitudinal risk factor for PTSD in military personnel (Putica et al., 2023) and especially from the scores on the DIF subscale (Edwards, 2022). One review and meta-analysis

on alexithymia in autism (Kinnaird, 2019) found a prevalence of 5% in the neurotypical population compared to 50% in those with autism spectrum disorder (ASD). In fact, the correlations between autism, alexithymia and emotional difficulties, such as impaired emotion recognition and empathy, have been highlighted through an ‘alexithymia hypothesis’ which posits that the emotional difficulties often associated with autism are in fact due to alexithymia, instead of autism per se, and thus only applicable to a subgroup within the ASD spectrum (Bird & Cook, 2013).

Gender or sex differences in alexithymia doesn’t seem to be a well-researched area. Studies based on samples where either sex or gender is strongly over-represented often point to differential findings (e.g. Honkalampi et al., 2022). Aston et al. (2020) refer to a “normative male” alexithymia which might indicate that there can be a societal aspect to the alexithymia construct. Some diagnoses strongly associated with alexithymia, such as ASD, are more commonly diagnosed in males, while others, such as eating disorders, are more commonly diagnosed in females. There is, thus, the possibility that the expression of alexithymia, rather than the underlying difficulties, differs between the sexes and genders.

Alexithymia was early classified as being both primary and secondary (Freyberger, 1977) and twin studies point to both genetic and environmental factors (Bagby et al., 2020). Childhood maltreatment and trauma have been suggested as causes for secondary alexithymia (Khan & Jaffee, 2022; Ditzer et al., 2023; Thomson, 2023). Meta-analytic findings (Khan & Jaffee, 2022; Ditzer et al., 2023) point to a correlation between alexithymia and maltreatment as a child or adolescent, with childhood emotional abuse, as well as emotional and physical neglect, being the strongest predictors for alexithymia in adulthood. In Khan & Jaffee’s (2022) meta-analysis, this correlation seemed to increase when more females were included in the study samples. Ditzer et al. (2023) connect the findings and draw parallels to Bowlby’s attachment theory (1958) in arguing that emotional maltreatment is an obstruction to developing a secure attachment and the ensuing poor emotional awareness may manifest as adult alexithymia. The association between alexithymia and insecure attachment has been identified in several studies (Oskis et al., 2013; Zhang et al., 2023). Epigenetically, prenatal cocaine exposure has been shown to lead to higher levels of alexithymia (Morie et al., 2023) and some changes in brain structure have been found in non-clinical women with alexithymic traits (Borsci et al., 2018).

Although there are other self-report measures to assess alexithymia such as Perth Alexithymia Questionnaire and Bermond Vorst Alexithymia Questionnaire (BVAQ), the TAS-20 “has become worldwide the most frequently and widely used measure of the alexithymia construct” (Bagby et al., 2020, p.1). Nevertheless, there have been controversies regarding, for example, the construct validity and internal reliability of the EOT factor, if the items can be divided into different subscales, and whether cultural values about emotions affect the scores (Bagby et al., 2020). Perhaps most objections have been around the question of whether a self-report measure can adequately assess the inability to identify and describe feelings, and whether negative affect may influence the results. Bagby et al. (2020) themselves recommend a multi-method approach and many studies (e.g. Gaigg et al., 2018; Preece et al., 2023) are complementing self-report measures with psychophysiological measures as a cross reference and to widen the understanding of the underlying mechanisms, especially since alexithymia has been associated with impairments in interoception (Gaigg et al., 2018).

## Aim and hypotheses

### Emotional regulation

Alexithymia is often referred to as an emotion regulation impairment (van der Velde et al., 2015), and several studies (Chen et al., 2011; van der Velde et al., 2015; Preece et al., 2023) have tried to discern wherein the emotion regulation difficulties manifest and have found examples of more maladaptive strategies, characterised by avoidance of emotions, such as suppression and ignoring, associated with alexithymia. There are contrasting conclusions on whether the difficulties lie in the emotional processing, the emotional regulation or in the process of selecting a regulatory strategy (van der Velde et al., 2015; Preece et al., 2023). Studies (Chen et al., 2011; Preece et al., 2023) have pointed to maladaptive regulation strategies in alexithymia, and Preece et al. (2022) suggested that there might be a difficulty in the actual selection of strategy. When using factor analysis to study the constructs of alexithymia, they found no loadings on difficulty fantasising or low emotionality, however they did find that high emotionality for negative events was correlated with alexithymia. If high emotionality occurs for negative events, one difficulty might be in choosing the right strategy for regulating, either as an effect of not recognising the emotion or perhaps from being overwhelmed (Preece et al., 2022). In previous literature, it has also been recognised that in daily life people use a range of cognitive and behavioural strategies to regulate their moods and emotions, and future studies have been recommended to assess a wider range of emotion regulation strategies for a “fuller account of the emotion regulation patterns characterizing alexithymia” (Preece et al., 2023, p. 233). Also, everyday responses (ERP) is an area that is predicted to become more important for studies of emotional regulation within psychophysiology (MacNamara et al., 2023). Little is known about whether certain everyday mood regulation strategies correlate with alexithymia and this study uses the Brief Music in Mood Regulation scale (B-MMR) (Saarikallio, 2012), which measures seven different types of mood regulation strategies: Entertainment - Happy Mood Maintenance; Revival - Relaxation and New Energy; Strong sensation - Intense Emotion Induction; Diversion - Distraction From Worries and Stress; Discharge - Release and Venting of Negative Emotion; Mental work - Contemplation and Reappraisal of Emotional Experience and Solace - Emotional Validation and Support When Feeling Down. This is a shorter version of the original MMR, which consisted of 40 items and was designed with young people in mind. The scale includes both strategies of dealing with negative emotion and strategies for maintaining and enhancing positive moods, the latter type of strategies have mostly been lacking from research on emotion regulation according to MacNamara (2023). Saarikallio (2012) also describes how some of the strategies (e.g., Entertainment, Strong Sensation) focus on the early stages of emotion induction or situation changes, while especially Discharge focuses on behaviour change after an affective state has already been activated (Saarikallio, 2012). Interestingly, an unexpected positive relationship between alexithymia and emotional responding to music has been reported by Lyers et al. (2020) and music of any kind should be a well-used tool for mood-regulation in general by students in the age group 18–19-year-olds. Since less use of adaptive emotion regulation strategies have been found to correlate with alexithymia in studies (Chen et al., 2011; Preece et al., 2023), and would follow from a lower ability to identify one’s own emotions and moods, it is hypothesised that those with higher scores on TAS-20 will report less use of the mood regulation strategies and/or a lower range of strategies. It is also hypothesised that these scores will correlate more with higher points on the factor scale measuring difficulties identifying feelings (DIF).

## Facial affect recognition

Previous research (e.g. Rosenberg et al., 2020) have identified a correlation between alexithymia and difficulties recognising facial expressions, and one study found that alexithymia could be diagnosed and predicted through machine learning models, using a facial emotion recognition task in combination with the scores on a somatisation subscale combined with anxiety and depression inventories (Farhoumandi et al., 2021). The Reading the Mind in the Eyes Test (RMET), where only the eyes of people's facial expressions are visible, was developed by Baron-Cohen et al. (1997) as a measurement of theory of mind in autism. People diagnosed with autism, as well as schizophrenia, have been shown to perform worse on the RMET (Kittel et al., 2022). The construct validity of the test when testing for theory of mind has, however, been questioned, and Kittel et al. (2022) argue that the test measures emotional perception rather than theory of mind. Hallerbäck et al. (2009) have shown that a Swedish version of the Reading the Mind in the Eyes Test (RMET) has good test-retest reliability and have defined the test as measuring face affect recognition rather than theory of mind. In a recent dissertation, the RMET was identified as the best predictor for primary, or the internal deficit subtype of alexithymia, as well as being the factor separating low and high alexithymia scores (Thompson, 2023). The participants in the study, however, were all male and studies (e.g. Greenberg et al., 2023) indicate that women have an on-average advantage on the English version as well as translated versions of the RMET test. It is hypothesised that lower (RMET) scores will correlate with higher TAS-20 scores, especially on the TAS-20 factor 2, difficulty describing feelings (DDF), and that this relationship will be stronger in a male population compared to females. It is also predicted that the total RMET scores will be lower in a male group compared to female.

## Locus of control

Despite controversies around the self-reported measure, the fact remains that the TAS-20 captures an alexithymia which is prevalent to a higher degree in clinical populations with a variety of psychopathologies and other conditions, and there is a possibility that the test captures something that affects resilience in general. Locus of control has been identified as a protective factor and as one of the cognitive components of resilience when psychosocial risk is present. Internal locus of control is linked to self-esteem, self-control and self-efficacy as well as the perception of having the ability to exercise control over important outcomes in life and implement actions to achieve objectives. People with internal locus of control have shown greater adaptive abilities and an ability to remain calm and determined in challenging situations (Di Pentima et al., 2019). Although studies have found benefits of having an external locus of control (Specht et al., 2011), it is generally seen as a risk factor on mental health which seems to be consistent across several countries and cultures. Khumalo & Plattner (2019) found that Botswanan university students that believed that chance or powerful others controlled their lives were more likely to have higher depression scores compared to those who believed that they themselves were in control of their lives. An external locus of control has been associated with higher levels of suicide risk in both adolescents (Evans et al., 2005) and older adults (Wilchek-Aviad & Cohen-Louck, 2022). Loftis (2014), however, found no significant relationship between locus of control and suicide risk, but between alexithymia and suicide risk, especially in females. Di Pentima et al. (2019) found that the role of locus of control works as a mediator between attachment and internalising problems such as depression and anxiety, but not between attachment and externalising problems, such as aggression. Some studies, however, indicate that both victims of relational aggression and the aggressors themselves have shown more extensive external locus of control compared to bystanders (Levy & Gumpel, 2022), and that mothers' sense of external locus of control can be related to an increased

parent–child aggression risk (Rodriguez, 2018). Although Giblett & Hodgins (2023) found no significant correlation between locus of control in relation to one’s own health and mental health, they did find a significant correlation between mental health and self-efficacy. Previous studies have found positive correlations between alexithymia, identified through TAS-26 and TAS-20, and external locus of control in the general population (Zimmerman et al., 2005). Among psychiatric outpatients, a negative correlation has been found between internal control and TAS-20 overall scores and, even stronger on the third factor scale, externally oriented thinking scores (EOT) (Hungry et al., 2016). The test used in this study, The Brief Locus of Control Scale (Sapp & Harrod, 1993), is a brief version of Levenson’s multidimensional locus of control scale. The scale is based on previous research linking locus of control with perception of risk and was chosen because it measures locus of control as a multidimensional construct and because of its brevity. It measures three dimensions of locus of control; Self, as Internal locus of control, Chance and Powerful others, where the latter two are considered external locus of control factors (Sapp & Harrod, 1993). It is hypothesised that higher scores on the TAS-20, and especially the scores on the subscale externally oriented thinking (EOT), will correlate with lower internal locus of control and higher scores on the external locus of control factors.

### Media use

Increased internet use has been discussed as a contributing factor of poorer mental health among youth (e.g. Hökby et al., 2016). Alexithymia has been identified as a predictor of problematic gaming (Liu et al., 2023) and several studies (Çelik et al., 2023; Martingano et al., 2022) have found a positive association between alexithymia and social media addiction, while Lyvers et al. (2022) found an association between alexithymia and internet addiction symptoms in general, but not social media use. Studies (e.g. Jiménez et al., 2019) have found relationships between reading comprehension, reading habits and emotional intelligence. It is hypothesised that higher scores on the TAS-20 will correlate with more time spent on online activities. It is also hypothesised that higher scores on the TAS-20 will correlate with less time spent reading or listening to books.

The aim of the present study was to explore common and differential relationships between facial affect recognition, mood regulation strategies, locus of control, media use and alexithymia, as well as to investigate whether factors contributing to poor mental health in general are captured in the TAS-20 test. The present study adds to the literature of the underlying reasons why alexithymia as defined by TAS-20 is prevalent to a higher degree, compared to the general population, in so many varying clinical populations, and what kind of difficulties young people with alexithymic traits experience in their everyday lives.

## Method

### Participants and procedure

Participants comprised one-hundred and fifty-eight 18–19-year-olds (65% females) recruited from Swedish upper secondary schools. Information about the study, including an information letter with a link to the online Qualtrics survey, was shared with forty-three upper secondary schools within three provinces in southeastern Sweden. The schools were primarily contacted with regards to the highest numbers of students and a wide variety of education programs offered, with no special regards to the type of education program. Eleven schools

explicitly agreed to share the information letter and the link to the survey with adult students in year three. Schools who chose not to participate most often stated the reason that they had already administered too many questionnaires and surveys to the students. Depending on the school's policy and organisation, the letter was either shared with the students via an administrator or via their teacher; it was, however, emphasised that participation was voluntary. The students consented to participate in the study by using the link to the online survey. Responses were collected during a six-week period. Two hundred -and- fifty-seven surveys were returned, however, ninety-nine questionnaires were excluded from data analysis since they were incomplete across all the scales and the final sample comprised 158 participants.

## Materials

The online survey was created via Qualtrics and contained no demographic questions except for gender. It included one measure of alexithymia, one measure of facial affection recognition, one measure of mood regulation strategies and one measure of locus of control as well as questions regarding media use. The original survey also contained one measure of autism phenotype. Students aged 18- to 19, in their third year in the upper secondary school were selected as the target group, as they are considered adults, while still school based. Since the target group was specified as one specific year group, age was not included as a variable. The online survey consisted of one demographic question (gender), the Swedish version of TAS-20 (Simonsson, et al., 2000), the Swedish version of Reading the Mind in the Eyes Test (Hallerbäck, et al., 2009), Brief Music in Mood Regulation Scale (Saarikallio, 2012) translated into Swedish, Brief Locus of Control Scale (Sapp & Harrod, 1993) translated into Swedish, as well as six questions on the use of different types of media and two questions regarding preferences of emotional regulation education in school. The form was estimated to take about 15 minutes to complete. An early version of the survey also included BAPQ-SE, comprising 36 questions assessing autistic traits with an additional 5 minutes to complete, however this test was later removed from the survey, since the length and extent of the longer survey seemed to have a negative effect on the uptake rate.

### Toronto Alexithymia Scale-20 (TAS-20)

The TAS-20 (Bagby et al., 1994) is a revised version of the initial Toronto Alexithymia Scale which consisted of 26 item statements. The TAS-20 is a self-report measure consisting of 20 items answered on a five-point Likert scale. It is constructed to capture three different factors; Difficulty Identifying Feelings: DIF: seven items (e.g. "When I am upset, I don't know if I am sad, frightened, or angry"); Difficulty Describing Feelings: DDF: five items (e.g., "I find it hard to describe how I feel about people") and Externally Oriented Thinking: EOT: eight items (e.g., "I prefer talking to people about their daily activities rather than their feelings"). The Swedish version of the TAS-20 (Simonsson-Sarnecki et al., 2000) was used and the TAS-20 has generally demonstrated good validity and reliability, although the EOT subscale usually has low reliability (e.g., Preece et al., 2023). All scores except the EOT subscale ( $\alpha = 0.59$ ) had good internal consistency ( $\alpha \geq 0.80$ ) in this sample.

### Reading the Mind in the Eyes Test (RMET)

The RMET (Baron-Cohen et al., 1997) consists of black and white images of people's faces with only the eyes visible. Each image has four options of emotion words or phrases to choose from to describe how the person is feeling, e.g. "playful, friendly, surprised, thinking of something". A Swedish translation (Hallerbäck et al., 2009) of the children's version, containing 28 images was used, which involves the same images as in the adult version, but with slightly easier words and no glossary needed. The test also included a practice example,



which was not included in the total score. Internal consistency for the total score was acceptable ( $\alpha = 0.67$ ) in this sample.

### **Brief Locus of Control Scale**

The Brief Locus of Control Scale (Sapp & Harrod, 1993) is a 9-item measure of three dimensions of locus-of-control with three questions for each dimension; 'self' (e.g. "I am usually able to protect my personal interests"); 'chance' (e.g. "When I get what I want, it's usually because I'm lucky") and 'powerful others' ("People like me have very little chance of protecting our personal interests where they conflict with those of strong pressure groups"). Separate subscale scores are derived for each strategy with three item statements for each strategy. Items are answered on a seven-point Likert Scale with the endpoints "strongly agree" and "strongly disagree." The test was translated into Swedish with back-translating. The internal consistency for the subscale measuring the 'chance' dimension was low in this sample ( $\alpha = 0.40$ ), but acceptable for 'powerful others' ( $\alpha = 0.69$ ) and internal locus of control ( $\alpha = 0.70$ ).

### **Brief Music in Mood Regulation Scale (B-MMR)**

The B-MMR (Saarikallio, 2012) is a 21-item measure of how frequently people use seven different music-related mood-regulation strategies; Entertainment: Happy Mood Maintenance (e.g., "I listen to music to make cleaning and doing other housework more pleasant"); Revival: Relaxation and New Energy (e.g., "When I'm exhausted, I listen to music to perk up"); Strong sensation: Intense Emotion Induction (e.g., "I feel fantastic putting my soul fully into the music"); Diversion: Distraction From Worries and Stress (e.g., "When I feel bad, I try to get myself in a better mood by engaging in some nice, music-related activity"); Discharge: Release and Venting of Negative Emotion (e.g., "When I'm really angry, I feel like listening to some angry music"); Mental work: Contemplation and Reappraisal of Emotional Experience (e.g., "When I'm distressed by something, music helps me to clarify my feelings") and Solace: Emotional Validation and Support When Feeling Down (e.g., "When I'm feeling sad, listening to music comforts me"). Separate subscale scores are derived for each regulatory strategy with three item statements for each strategy. Items are answered on a five-point Likert scale, with higher scores indicating more frequent use of that strategy. The test was translated into Swedish with back-translating. The B-MMR has demonstrated good internal consistency reliabilities and correlation with measures of general emotion regulation. It had strong internal consistency ( $\alpha = 0.96$ ) for the total score and ( $\alpha = 0.80- 0.90$ ) for the separate strategies in this sample.

### **The Broad Autism Phenotype Questionnaire-Swedish Version (BAPQ-SE)**

The BAPQ was "developed to identify the broad autism phenotype (BAP) in first-degree relatives of individuals with autism spectrum conditions" and the Swedish version was used (Bang et al., 2022, p.1). It consists of 36 statement items such as, "I like to try new things" and is answered on a 6-point Likert scale with the end points "very seldom" and "very often". Fifteen items were reverse scored. It had good internal consistency ( $\alpha = 0.89$ ) for the total score in this sample.

### **Media use**

Questions were designed to assess the weekly use of six different types of media: "How many hours a week do you spend on; being online; social media; computer games; books (paper); e-books; audiobooks. There were four answer options; 0-5, 5-10, 10-20, 20+ hours a week to select from. In the analysis a pre-selected average number of hours for each choice was used; 2 hours for the first option, 7 hours for the second option, 15 hours for the third option and 25 hours for the fourth option. For simplification of the media use variables, the

data showing weekly hours spent on; paper books, audio books and e-books were combined as one variable, Books.

## **Ethical considerations**

The online link and/or a PDF of the contents of the survey were shared with the schools to be looked at before sharing it with their adult students. Participation was voluntary and anonymous. No questions were compulsory, the students could skip questions or exit the survey at any point. No demographic data, except for gender, was requested.

## **Analytic strategy**

### **Data preparation**

All analyses were conducted using SPSS 29. Ninety-nine out of 257 responses (39%) were omitted due to non-completed answers of a single test. The number of samples for each test vary with regards to completed answers; TAS-20 ( $N = 158$ ), RMET ( $N = 150$ ), Brief Locus of Control Scale ( $N = 153$ ), The Brief Music in Mood Regulation scale (B-MMR) ( $N = 130$ ), BAPQ ( $N = 40$ ) and media use ( $N = 123, 125, 126$ ).

### **Main analysis**

Pearson correlations were used to examine raw correlations between variables, and two-tailed independent samples  $t$ -tests were used to determine gender differences. For both analyses 5000 bootstrapped samples with 95% confidence intervals were used due to some variables, especially for media use, being highly skewed. Multiple linear and hierarchical regression analyses were used to determine whether the variables predicted scores on the TAS-20. Scatterplots of residuals and P-P plots were used to assess homoscedasticity and normality of residuals, however, since the raw data of several predictor variables had a non-normal distribution, 5000 bootstrapped samples with 95% confidence intervals were utilised. Tolerance statistics were used to assess independent variables for multicollinearity. Solace, one of the regulatory strategies in the B-MMR, was found to correlate too much with the other strategies based on tolerance and VIF score and was not included in the hierarchical regression analysis. Due to the much smaller sample size, the BAPQ scores were analysed separately against the TAS-20 scores in all correlation and regression analyses.

# **Results**

## **Alexithymia**

The TAS-20 scores were analysed as a total as well as the totals of each subscale, DIF scores DDF scores and EOT scores. Following the cut off points for the TAS-20 total scores, three groups were identified; non-Alexithymia: 0-51 ( $N = 47$ ) 30%; possible Alexithymia: 52-60 ( $N = 59$ ) 37% and Alexithymia:  $61 \geq$  ( $N = 52$ ) 33%. As seen in Table 1, there was a significant effect for gender (females = 103, males = 51) on the total TAS-20 scores, with women attaining higher scores than men. The effect size, as measured by Cohen's  $d$ , however indicated a small effect ( $d = 0.42$ ). There was also a significant medium effect for gender on DIF scores with women attaining higher scores than men, and a significant small effect for gender on DDF

scores with women again attaining higher scores than men. No significant effect for gender on EOT scores was found (see Table 1).

**Table 1**  
*Descriptive Results and t-test Results of Gender Differences for all Predictor Variables*

	<i>N</i>	<i>M (SD)</i>	Women	Men	<i>t</i>	<i>p</i>	<i>d</i>
			<i>M (SD)</i>	<i>M (SD)</i>			
<b>TAS<sup>1</sup>-20</b>	158 <sup>a</sup>	55.79 (11.01)	57.16 (10.59)	52.45 (11.42)	2.53	.014	0.43
DIF <sup>2</sup>		18.83 (6)	20.02 (5.84)	16.04 (5.52)	4.05	<.001	0.69
DDF <sup>3</sup>		15.28 (4.6)	15.79 (4.6)	14 (4.49)	2.29	.025	0.39
EOT <sup>4</sup>		21.68 (4.59)	21.35 (4.55)	22.41 (4.74)	-1.34	.181	-0.23
<b>Locus of Control</b>							
Self	153 <sup>b</sup>	14.88 (3.07)	14.40 (2.86)	15.86 (3.26)	-2.83	.006	-0.49
Chance		11.99 (2.92)	12.23 (2.73)	11.59 (3.31)	1.27	.230	0.22
Powerful others		10.52 (3.31)	10.26 (3.1)	10.88 (3.74)	-1.09	.296	-0.19
RMET <sup>5</sup>	150 <sup>c</sup>	19.46 (3.96)	20.01 (3.19)	18.67 (4.73)	2.03	.079	0.35
<b>B-MMR<sup>6</sup></b>	130 <sup>d</sup>	71.44(21.65)	74.73 (20.39)	63.80 (22.87)	2.71	.010	0.52
Entertainment		12.52 (3.11)	13.17 (2.53)	11 (3.75)	3.33	.002	0.73
Revival		9.88 (3.80)	10.10 (3.83)	9.35 (3.75)	1.04	.302	0.20
Strong sensation		10.78 (3.64)	11.29 (3.24)	9.60 (4.24)	2.48	.031	0.47
Diversion		10.03 (3.90)	10.43 (3.80)	9.10 (4.05)	1.78	.075	0.34
Discharge		9.15 (3.98)	9.62 (3.98)	8.13 (3.9)	1.98	.049	0.38
Mental work		9.28 (3.84)	9.67 (3.9)	8.38 (3.66)	1.79	0.74	0.34
Solace		9.8 (4)	10.45 (3.93)	8.25 (3.76)	2.98	.003	0.57
<b>Media use</b>							
Online	126 <sup>e</sup>	13.5 (8.71)	12.52 (8.81)	15.69 (8.29)	-1.90	.055	-0.37
Books		9.86 (8.76)	10.35 (9.5)	8.87 (7)	0.87	.386	0.17
Social media	125 <sup>f</sup>	11.35 (8.27)	12.05 (7.96)	9.89 (8.95)	1.34	.184	0.26
Computer games	123 <sup>g</sup>	8.90 (5)	7.09 (0.87)	13.11 (7.54)	-4.84	<.001	-1.43
BAPQ <sup>7</sup>	40 <sup>h</sup>	112.4 (22.08)	113.67 (22.77)	108.60 (20.51)	0.62	.537	0.23

Note. Based on 5000 bootstrap samples.

<sup>1</sup>Toronto Alexithymia Scale, <sup>2</sup>Difficulties Identifying Feelings, <sup>3</sup>Difficulties Describing Feelings,

<sup>4</sup> Externally Oriented Thinking, <sup>5</sup>Reading the Mind in the Eyes Test, <sup>6</sup>Brief Music in Mood

Regulation Scale, <sup>7</sup>The Broad Autism Phenotype Questionnaire

<sup>a</sup> 103 Females, 51 Males, 4 No answer <sup>b</sup> 98 Females, 51 Males, 4 No answer <sup>c</sup> 98 Females, 49 Males,

3 No answer <sup>d</sup> 89 Females, 40 Males, 1 No answer <sup>e</sup> 86 Females, 39 Males, 1 No answer <sup>f</sup> 86

Females, 38 Males, 1 No answer <sup>g</sup> 85 Females, 37 Males, 1 No answer <sup>h</sup> 30 Females, 10 Males.

### Regulatory strategies

The total scores of the B-MMR were found to be positively correlated with the total TAS-20 scores, the DIF scores and the DDF scores, but not with the EOT scores (see Table 2). In a simultaneous linear regression analysis of the separate mood regulation strategies ( $F(6,129) = 3.45, p = .003, R^2 = .144, R^2_{adj} = .102$ ), higher scores on the strategy Entertainment correlated with higher total TAS-20 scores, ( $b = .97, 95\% CI [0.13, 1.9]$ ), while lower scores on the

strategy Revival correlated with higher total TAS-20 scores ( $b = -1.12$ , 95%  $CI [-2.14, -.196]$ ). As seen in Table 1, there was a significant medium effect for gender on the total scores of the B-MMR with women reporting higher scores than men. Out of the separate strategies, significant effect for gender, also with women reporting higher scores than men were found for Entertainment and Solace with a medium effect size, and for Strong sensation and Discharge with a small effect size (see Table 1). It was predicted that those with higher scores on TAS-20 would report less use of the mood regulation strategies and/or a lower range of strategies, especially correlating with factor DIF. However, higher total scores of the B-MMR were associated with higher total scores on the TAS-20, as well as on the subscales DIF and DDF, while Revival was the only strategy where lower reported results indicated higher TAS-20 total scores.

**Table 2**  
*Pearson Correlations between the TAS<sup>1</sup>-20 scores and Predictor Variables*

	TAS-20 total	DIF <sup>2</sup>	DDF <sup>3</sup>	EOT <sup>4</sup>
RMET <sup>5</sup>	-.04	.04	.02	-.16
<b>B-MMR<sup>6</sup></b>				
Total	.22*	.31**	.24**	-.17
Entertainment	.22**	.31***	.25**	-.11
Revival	.12	.23*	.16	-.16
Strong sensation	.18	.28**	.19*	-.12
Diversion	.25**	.28**	.26**	-.03
Discharge	.10	.20*	.14	-.16
Mental work	.23*	.39***	.22*	.18
Solace	.18	.34***	.20*	-.23*
<b>Locus of Control</b>				
Self	-.43***	-.38***	-.36***	-.18
Chance	.41***	.40***	.34***	.13
Powerful others	.35***	.27**	.32***	.18
<b>Media use</b>				
Social media	.19*	.16	.18	.05
Online	.05	.01	.08	.00
Computer games	-.03	-.19*	-.03	.18
Books	.02	.04	.09	-.08
Gender	-.14	-.25**	-.13	.12
BAPQ <sup>7</sup>	.27	.11	.22	.37*

Note. Based on 5000 bootstrap samples. <sup>1</sup>Toronto Alexithymia Scale, <sup>2</sup>Difficulties Identifying Feelings, <sup>3</sup>Difficulties Describing Feelings, <sup>4</sup>Externally Oriented Thinking, <sup>5</sup>Reading the Mind in the Eyes Test, <sup>6</sup>Brief Music in Mood Regulation Scale, <sup>7</sup>The Broad Autism Phenotype Questionnaire

\*\*\*Correlation is significant at the  $< .001$  level (2-tailed). \*\*Correlation is significant at the 0.01 level (2-tailed). \*Correlation is significant at the 0.05 level (2-tailed).

## Facial Recognition

It was found that the total RMET scores were not significantly predictive of any of the TAS-20 scores; neither the total scores, DIF scores, DDF scores nor the EOT scores, (see Table 2). Pearson correlations, however, indicated a significant positive correlation between the total

RMET scores and weekly hours spent on social media,  $r(113) = [0.25]$ ,  $p = [.007]$ . There were no findings of a significant effect for gender on the total RMET scores, although women attained higher scores than men (see Table 1). The mean of the RMET score were lower in men than in women, although not significantly so. The hypotheses that total RMET scores would correlate with higher TAS-20 scores, especially on the DDF subscale, and that this relationship would be stronger in a male population compared to female are thus not supported.

### Locus of Control

Pearson correlations indicated that the TAS-20 total scores were negatively correlated with internal (Self) locus of control, while positively correlated with the external locus of control factors, Chance and Powerful others (see Table 2). Linear regression results indicate that both lower scores on internal (Self) locus of control,  $R^2 = .175$ ,  $F(1, 142) = 30.04$ ,  $p < .001$ , and higher scores on Chance,  $R^2 = .140$ ,  $F(1, 143) = 23.32$ ,  $p < .001$ , and Powerful others,  $R^2 = .137$ ,  $F(1, 143) = 22.79$ ,  $p < .001$ , explained a significant proportion of variance in TAS-20 total scores. In hierarchical regression, the internal and external loci of control factors together explain 36% of the variance (see Table 3). There was also a significant effect for gender on internal locus of control, with women achieving lower scores, but no significant effect for gender on either type of external locus of control was found (see Table 1). It was predicted that higher scores on the TAS-20, and especially the scores on the factor scale externally oriented thinking (EOT), would correlate with lower internal locus of control and higher scores on the external locus of control factors. This hypothesis is partially supported as both lower scores on internal locus of control as well as higher scores of external loci of control factors significantly predicted higher TAS-20 scores. However, highly significant correlations were found on the total TAS-20 scores and the DIF and DDF subscales, but not on the EOT subscale (see Table 2).

### Media use

Pearson correlations indicate a positive correlation between weekly hours spent on social media and total TAS-20 scores and a negative correlation between weekly hours spent on computer games and the DIF scores (see Table 2). As seen in Table 1, there was a large effect for gender on computer games with men spending more hours per week on computer games than women. In hierarchical regression, a significant correlation was found for weekly hours spent on social media (see Table 3). The hypothesis regarding different online activities should be examined more distinctly, while the hypothesis that higher scores on the TAS-20 will correlate with less time reading or listening to books was not supported.

### Autism phenotype

The BAPQ total scores were not found to have a significant effect on the TAS-20 total scores,  $R = .28$ ,  $F(1, 35) = 2.95$ ,  $p = .13$ , the DIF scores,  $R = .16$ ,  $F(1, 35) = .95$ ,  $p = .34$  or the DDF scores,  $R = .21$ ,  $F(1, 35) = 1.61$ ,  $p = .21$ . It was, however, found that the BAPQ scores significantly predicted EOT subscale scores,  $b = 0.67$ ,  $t(38) = 2.13$ ,  $p = .010$  and explained a significant proportion of variance in the EOT scores,  $R^2 = .106$ ,  $F(1, 38) = 4.52$ ,  $p = .040$ . No significant effect for gender was found (see Table 1).

**Table 3**  
*Hierarchical Regression of Total TAS<sup>1</sup>-20 scores*

	Regression 1	Regression 2	Regression 3
Gender (0, female; 1, male)	-1.27	.28	-.04
<b>Locus of Control</b>			
Self	-1.52***	-1.46***	-1.5***
Chance	1.34***	1.18***	1.2**
Powerful others	0.61*	0.60*	0.61*
<b>B-MMR<sup>2</sup></b>			
Entertainment		0.78*	0.97*
Diversion		0.51	0.49
Mental work		0.31	0.19
Revival		-0.98*	-1*
Discharge		-0.30	-.02
Strong Sensation		0.18	-.07
RMET <sup>3</sup>		-0.39	-0.57*
<b>Media use</b>			
Social media			0.35*
Computer games			0.21
Online			-0.08
Books			-0.28
<b>R<sup>2</sup></b>	.36	.42	.47
<b>R<sup>2</sup> change</b>	.36	.06	.05

Note. Based on 5000 bootstrap samples. <sup>1</sup>Toronto Alexithymia Scale, <sup>2</sup>Brief Music in Mood Regulation Scale, <sup>3</sup>Reading the Mind in the Eyes Test

\*\*\*Correlation is significant at the < .001 level (2-tailed). \*\*Correlation is significant at the 0.01 level (2-tailed). \*Correlation is significant at the 0.05 level (2-tailed).

## Discussion

The objective of the study was to examine how issues associated with the alexithymia construct affect adolescents in a non-clinical population in everyday life and whether there are components that affect overall mental health. The findings show that both a lack of internal control and a greater belief that situations are controlled by chance or powerful others were associated with alexithymia as measured by the TAS-20. Higher scores on music related mood regulatory strategies were also related to higher TAS-20 scores, while such correlations were not found for facial affect recognition. About one-third of the participants obtained scores falling within a high alexithymia range and a significant difference was observed between the two genders, with women obtaining higher scores on the total scale and two of the three subscales. Significant gender differences were also found for internal locus of control scores where women obtained lower scores, and total score of regulation strategies, where women obtained higher scores. A significant correlation between weekly hours spent on social media and the total TAS-20 scores was found. The predictors for the scores on the EOT subscales,

externally oriented thinking (EOT) differed from the total TAS-20 scores and the other two subscales. The scores obtained for the autism phenotype questionnaire correlated positively with only the EOT subscale scores.

The mean scores of the TAS-20 are unusually high for a non-clinical population, with 33% of the participants falling within an alexithymia range. There is a possibility that the students opting to participate in this study would already have had some interest in the topic, and the questioning could have led to self-reporting bias where the phrasing or presenting of the study could have led the students to responding in a way that they thought were expected of them. Alexithymia has, however, been reported as more commonly observed in adolescents, during their rapid cognitive and psychosocial growth, compared to adults (van der Crujisen et al., 2019) and a similar result was found in a study of alexithymia and self-consciousness in 14 to 19-year-olds in Iran where 29.8% of the adolescents were found to be within the alexithymia range (Ziaei et al., 2023). Due to the sample collection procedure, it is not possible to draw any conclusions around the particular demographic circumstances or characteristics of participants who chose to partake in the study, other than that more women than men chose to participate. It is possible that emotions and mental well-being could be considered more of a female interest among Swedish adolescents. The means were also significantly higher for women than men, which was not expected. Similar results were found in a recent study of alexithymia in Polish 15–19-year-olds during the Covid pandemic, Szepietowska et al. (2023) found 31% of the adolescents being alexithymic, another 25% possibly alexithymic and higher scores for females compared to males on the total TAS-20 scores as well as on the DIF and DDF subscales, but not on the EOT subscale. Bagby et al. (2020) themselves discuss the effects of social constructs on alexithymia and refer to studies where both men and women from three Arabic-speaking countries scored higher on the TAS-20 compared to English-speaking Canadian men and women, while other previous studies have found alexithymia to be more common in females during adolescence, with the reverse pattern featuring in adulthood (van der Crujisen et al., 2019).

Emotional regulation is arguably the area most associated with alexithymia and previous studies have pointed to a greater use of more maladaptive emotional regulation strategies, such as suppression or ignoring, associated with alexithymia. In this study music related mood regulatory strategies were examined, and the findings did not support the prediction of an association between alexithymia and less use of the different mood regulation strategies, being most evident on the DIF subscale scores. To the contrary, higher total scores on the B-MMR correlated with higher total TAS-20 scores as well as DIF and DDF subscale scores. The correlation matrix showed significant correlations, especially between the DIF subscale scores, and several regulatory strategies. However, while the mood regulatory strategy, Entertainment: happy mood maintenance, correlated positively with the total TAS-20 scores as well as the DIF and DDF factor scores, there was a negative correlation between the regulation strategy, Revival: relaxation and new energy, and the total TAS-20 scores. Entertainment could arguably be the most common use of music and doesn't require much consideration of one's cognitive or affective state. The results of a greater use of music related strategies associated with alexithymic traits are somewhat in line with Lyers et al.'s (2020) findings of a positive relationship between alexithymia and emotional responding to music. Lyers et al. (2020) argue that those with alexithymia seem to rely on external means to regulate their mood because of emotional self-regulation deficiencies and draw parallels to the association between alexithymia and substance misuse, where alexithymic music listeners might use the music to induce or release emotions. Music listening for entertainment could thus be seen as an adaptive emotion regulation strategy.

Locus of control is associated with self-esteem and self-efficacy and a lack of a sense of internal control is associated with mental health problems. The direction of causality, whether

difficulties identifying and describing feelings lead to lower internal and higher external locus of control or whether low internal and high external locus of control lead to difficulties identifying and describing feelings, cannot be determined from this study. However, the correlation can give a clue to in what way alexithymia and emotional dysregulation are related to the wide variety of conditions and diagnostic disorders. Using the same locus of control factors, Self, Chance and Powerful others, Khumalo & Plattner (2019) found a correlation between low internal and higher external locus of control and depression, while Brytek-Matera (2008) found deficient experiences of control correlating with Anorexia nervosa. A gender difference in scores were only found on the internal factor scale but not on the two external locus of control factors. Previous studies have found gender differences in internal locus of control and Churchill et al., (2020) suggest that “at the mean a unit increase in internal LoC for females would narrow the mental health gender gap by 2.2%” (Churchill et al., 2020, p.741). However, the causes for this difference and what processes form locus of control, do not seem well-understood. Whether anger or aggression is expressed inwardly or outwardly could possibly be related to locus of control. In a study on Swedish women with eating disorders, affect school, which “aims to enhance emotional awareness and the ability to perceive and express emotions”, has proven beneficial (Pettersson & Wåhlin, 2022, p.1). Since poor interoceptive abilities have previously been associated with alexithymia (Gaigg et al., 2018; van der Crujisen et al., 2019), and also more with females compared to males (van der Crujisen et al., 2019), it is possible that deficiencies in reading signals of the internal state of the body could be related to a lack of internal locus of control.

Facial affect recognition was the only factor assessed using a task measure. It was not found to be a consistent significant factor for the TAS-20 scores and the advantage for female participants in terms of the RMET scores was not found to be significant. Since the test is not designed for online use, there is a possibility that there is not a good translation between paper and pen and online. There is also the possibility that the specific task has been practised by today’s adolescents through extensive viewing of images and video clips online as well as video calling, with many times only the face visible. This theory could be supported by the finding that there were indications of a relationship between the RMET scores and weekly hours spent on social media. The ability to identify and describe the feelings experienced from the eyes of a real person in a real meeting compared to online may however differ considerably. Alexithymia, as well as empathy, has both a cognitive and affective component and while emotional regulation supposedly is more related to the affective component, facial affect recognition might be more related to a cognitive component.

Screen time use and influences from social media are often featured in explanations of increasing mental health problems in young people and since a correlation between higher TAS-20 scores and time spent on social media was also found, exactly how different types of screen time activities impact on alexithymia and empathy should be further examined.

In line with Bagby et al.’s (2020) findings, the predictors of the EOT subscale scores differed from the total TAS-20 scores and the other two subscale scores in this study, “a substantial portion of variance in EOT factor scale scores was reflective of variation on a construct somewhat separate from the construct assessed by total scores, while a smaller portion of variance was reflective of the construct assessed by total scores” (Bagby et al., 2020, p.5). Interestingly, autistic traits showed up as relevant significant predictor on the EOT subscale. Although Preece et al. (2022) found no loadings on difficulty fantasising in the alexithymia construct, Bagby et al. (2020) claim that there “is accumulating evidence, however, that the EOT factor scale assesses this facet of the alexithymia construct indirectly” and noted that the EOT factor scale has correlated negatively with the proneness to imagine emotions and behaviour in fictitious characters (Bagby et al., 2020, p.7). Static play and a lack of imagination are often associated with autism spectrum disorder. Trauma is denoted as a possible cause for



secondary alexithymia and children who have experienced trauma are often prescribed play therapy. In a longitudinal study Normandin et al. (2023) indicate that being “encouraged to express their preoccupations through pretend play and gain mastery through completing play narratives, may be of particular therapeutic value for young children” (Normandin et al., 2023, p.131). Considering the great gender differences in weekly hours spent on computer games, children spend time on different activities when growing up and into young adulthood, and different activities may offer different opportunities for gaining mastery and completing narratives in a playful setting.

## **Limitations and further research**

One of the limitations of the study is that only students from upper secondary schools participated. It is possible that the results and gender differences would have looked different if a wider selection of adolescents from the same age group had participated since not all adolescents go on to study at upper secondary schools. Only 30% of the study sample were below the cut-off point (52 points) for alexithymia or possible alexithymia and this made 70% of the participants represent alexithymia or borderline alexithymia, which is an unusually high number. Due to the way the surveys were administered, it is not possible to know the reasons why classes and students chose to participate or not to participate in the study, and whether this was affected by the way the survey was presented. While facial affect recognition was assessed using a task measure, all the other variables were measured by self-report, which is susceptible to response bias and there was no assessment of how focused or compliant the participants were. Gender was the only demographic data collected and age was not used as a variable. The age group is right on the cusp for valid psychometric properties, since good quality of self-report assessment on the TAS-20 has been found in young adults (19 to 21 years old) with declining quality in older adolescents (17 to 18 years old), which is thought to be due to the reading and comprehension level needed to understand and answer the statements (Bagby et al., 2020). Other factors that also could have influenced the participants’ reading and comprehension level, such as having Swedish as an additional language, are not known. For analytical purposes, surveys with only some of the measures completed were included, which resulted in different numbers and power between the various regression analyses, while the internal validity coefficients for both external locus of control factors were below good. Furthermore, the questions on media use were not standardised and the weekly use was only estimated at, with four different choices, due to a want of ease of response for the participants, which resulted in highly skewed data. Different questioning on media use with more distinct categories where the participants were asked to fill in the number of hours spent using different media may have produced more distinct and representative data.

As many of the mental health problems and diagnoses of various disorders, that are often identified as an increasing problem among the young population in our society, have been associated with alexithymia, it would be beneficial to further investigate the role of lack of internal locus of control and high external locus of control on poor mental health in the adolescent population. Further research should focus on what factors influence how locus of control is formed and how internal locus of control can be achieved and maintained, as well as what types of therapies that work best for developing a sense of agency and shifting an external locus of control to a more internal locus of control. Gender differences in mental well-being and how poor mental health is expressed warrant further investigations. The mediating effect of a lack of internal locus of control should be especially examined in conditions, such as eating disorders, anxiety and depression, which affect females to a higher degree. Strategies for emotion regulation could also be gender influenced and adaptive strategies for use in everyday life should be further investigated. Assessing younger children’s risk of developing mental health problems could possibly be linked with assessing the ability to fantasise and imagine

characters' emotions and behaviours, and further techniques for assessing children's and young people's mental well-being without relying on verbal self-reporting should be developed. Considering the high prevalence of alexithymia and the increasing concerns of mental health problems in young people, it would be beneficial to investigate how to introduce training on emotional awareness and emotion regulation strategies in school settings.

## **Conclusion**

The results are in line with the hypothesis that there is something captured in the TAS-20 that relates to mental health in general. Internal locus of control was negatively associated, and external locus of control was positively associated with alexithymia. Music-related mood regulatory strategies were also found to be positively associated with alexithymia. Women reported lower scores on internal locus of control and higher scores on music-related mood regulatory strategies as well as alexithymia as assessed by the TAS-20.

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