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ABSTRACT

Rationale: Clustering techniques have been used within intervention studies to locate any distinct subgroups among intervention participants. One way in which they have not yet been utilized, but for which there is potential benefit, is in finding different motivational and behavioral response types to a newly introduced behavior.
Objective: This study aimed to use latent profile analyses (the same as latent class analyses except with continuous indicator variables) to identify 1) types, or classes, in terms of social cognitive responses to a mindfulness intervention, using The Reasoned Action Approach constructs, and 2) longitudinal/change trajectory classes of the target behavior (i.e., mindfulness practice).
Methods: The data derived from a school-based mindfulness intervention (N = 1646) among 12-15 year-olds, conducted in southern Finland from 2014 to 2016. We explored associations between the identified classes and with gender, linguocultural group, and mental health and practice outcomes.
Results: Analyses indicated a solution of five latent classes for both social cognition post-intervention—Uncertain but Positive (40.2%), Acceptable but No (18.8%), Indifferent (16.8), Inclined (15.5%), Disinclined (8.6%)—and practice trajectories—Stable Low (52.1%), Decreased from Seldom (25.8%), Decreased from Sometimes (10.7%), Increased from Zero (6.8%), Increased from Seldom (4.6%). The strongest differentiating theoretical construct among the social cognitive classes was a descriptive norm. The classes were characterized by some associations between each other (e.g., "Acceptable but No" and "Stable Low") and with linguocultural groups (e.g., "Inclined" and small language minorities) and mental health (e.g., "Disinclined" and externalization and depressive symptoms), but no specific associations were found by gender.
Conclusions: This study shows how more person-centered analyses can be utilized in process evaluations, which predominantly only make use of variable-centered analyses. This knowledge could suggest ways to tailor universal interventions for subgroups with different receipt profiles and thereby improve intervention acceptability and engagement.

1. Introduction

Calls have been made for more research into *why* interventions work, as only reporting *if* interventions work does not provide information on how they can be replicated successfully (Deaton and Cartwright, 2018; Moore et al., 2015). It is important in research to find out how effects are caused and for whom (i.e., what strata of the sample are affected by what). In other words, process evaluations including an investigation of

into heterogeneity of effects are necessary. Process evaluations can cover three areas: an examination of intervention delivery (implementation), an examination of how effects were caused (mechanisms of impact), and an examination of what external factors were involved (context). Theories and concepts in social and behavioral science can be used in process evaluations to highlight what factors and pathways to inspect (Hagger et al., 2020). For example, researchers have investigated mechanisms of impact by examining what psychological constructs (e.

g., self-efficacy and perceived norms), are associated with improved changes in intervention targets (Beattie et al., 2020; Beattie et al., 2022). This study examines aspects of mechanisms of impact and context in a mindfulness intervention.

When intervention evaluators conduct process evaluations, they usually do so in the entire sample, discovering average associations and average pathways in the entire sample while sometimes acknowledging the need to identify and address inequities (Hagger et al., 2020). In past research on mindfulness practice, researchers have analyzed the sample overall, using the Reasoned Action Approach (further explanation can be found below) to explore social cognition about and the behavior of practice in a mindfulness intervention (Beattie et al., 2019; 2020). The Reasoned Action Approach models drivers of motivation underlying behavior change, including perceptions of others' behavior (descriptive norm) and their approval (injunctive norm), benefits and disadvantages of behavior (attitudes and outcome expectations), and perceived behavioral control. Past research using the Reasoned Action Approach to explain mindfulness practice has found high levels of perceived behavioral control, positive outcome expectations, and injunctive norms and medium levels of descriptive norms and negative outcome expectations (Anonymous, 2020). It also found that these variables, except for perceived behavioral control, explain intention to practice mindfulness exercises in the sample overall. However, investigating only the sample overall obfuscates any variances in responses to interventions that different participants may have so it is worthwhile to have a closer look. Looking for patterns in responses—that is, subgroups or classes in the sample who responded in a similar way across several variables—can enrich intervention evaluations and are one way to investigate contextual factors—factors external to the intervention such as subgroup differences. This method may, for example, help solve the problem with universal interventions sometimes inadvertently increasing inequities (Lorenc et al., 2013) by locating possible subgroups who responded differently to the intervention and may benefit from a different approach. This way, different types of participants can experience an intervention that is optimized for them.

The analysis of subgroups has been used in some areas of process evaluations already, such as in finding subgroups in an intervention's delivery (Shin et al., 2014). It has also been used to locate *subgroups in baseline factors that predict treatment outcome* (Saunders et al., 2016; Tanaka and Nolan, 2018; Uckelstam et al., 2019), find differing *risk groups for tailoring interventions* (Hillhouse et al., 2016; Rijbroek et al., 2019), and examine different *profiles of participant engagement in intervention component use* (Demment et al., 2014) and *beliefs about the target behavior* (Patrick and Maggs, 2010; Stapleton et al., 2010). Stapleton et al. (2010) found four different profiles of outcome expectations and normative beliefs about tanning bed use and associations between the belief profiles and use behavior after an information-based intervention to prevent skin cancer. They discussed how identifying different subgroups by tanning beliefs could be used to tailor interventions. However, to our knowledge, researchers have not yet used a subgroup analysis to find different profiles of social cognitive and behavioral responses after a novel behavior was introduced in an intervention. By analyzing subgroups in social cognitive and engagement response, we can better see nuances in intervention reception, and intervention evaluators can then further investigate the subgroups to find out what worked and did not work for whom. For example, an intervention evaluator could identify a subgroup that believes that the target behavior(s) is/are beneficial but they are unable to adhere to it/them. These participants could then be interviewed about what the particular barriers are and how they can be overcome. This way, intervention developers can identify areas in which their interventions can be adapted to suit different subgroups in their samples.

This study analyses a school-based mindfulness program in which not many participants practiced the mindfulness exercises regularly. School-based mindfulness programs have shown promise in a wide range of positive outcomes from improving well-being and classroom climate to decreasing depressive symptoms and problems with executive functioning (McKeering and Hwang, 2018; Zenner et al., 2014). However, practice outside of the programs has been sparse if even reported (Zenner et al., 2014), which means that after mindfulness interventions end, adolescents are not capitalizing on any benefits. More research is needed on the practice aspect of mindfulness interventions. The lack of practice impedes the advancement of scientific knowledge about mindfulness practice and its benefits. Without sufficient practice, there can be neither more rigorous evaluations of its effectiveness among youth nor assessments of the optimal amounts of practice for establishing recommendations.

As alluded to earlier, the Reasoned Action Approach is a theory that can be used to examine a behavior such as engaging in mindfulness practices and what leads to its uptake as part of a process evaluation (Ajzen, 2011). Moreover, there is ample empirical evidence that this theory is useful in explaining a variety of health behaviors (McEachan et al., 2016). Still, at this point, not many studies have used the Reasoned Action Approach to predict mindfulness practice behaviors. A few studies have investigated the Reasoned Action Approach in the context of adolescents' meditation practice after being taught about mindfulness in a school setting. They have generally found that perceived norms and attitudes toward mindfulness practice, but not self-efficacy, predict intention, and intention predicts mindfulness practice (Anonymous, 2019; 2020; Erbe et al., 2018, 2019).

The current exploratory study delves into the potentially different response types or classes of participants hidden behind the mean. These differences are usually hidden in analyses of the overall sample mean; by using latent profile analyses, we are demonstrating a new way to understand the intricacies of intervention reception.

To show how to use the latent group/trajectory analysis for intervention evaluation, this study asks the following research questions:

1. First, to analyze latent classes among the intervention participants:
   a Are there distinct profiles of participants among the social cognitive variables, specifically negative and positive outcome expectations, descriptive and injunctive norms, self-efficacy, and intention, immediately post-intervention?
   b. Are there distinct classes of participants with regard to their trajectories of mindfulness practice from baseline to 26 weeks?
2. Next, to explore the associations between the classes and other variables of interest:
   a. Are there sociodemographic differences, specifically gender and linguocultural group, between the classes?
   b. How are the social cognitive and practice trajectory classes associated with each other?
   c. How are the social cognitive and mindfulness practice trajectory classes associated with externalization, internalization, depressive symptoms, and resilience across time?
   d. How are the social cognitive classes associated with mindfulness practice behavior across time?

The first latent profile analysis examines social cognitions cross-sectionally about a week after the intervention and the second examines longitudinal practice variables from baseline to 26 weeks. Specifically, in the first analysis, participants are analyzed for different patterns in outcome expectations (both positive and negative), perceived norms (both descriptive and injunctive), self-efficacy, and intention after the nine-week intervention. In the second analysis, longitudinal patterns reveal what different behavioral trajectories may be in the data. There may be subgroups that increased, decreased, or fluctuated over time, while the whole group's average practice remained stably low over time.

The subgroups are then explored in new areas of inquiry to learn more about them: linguocultural group, gender, mental health, practice, and against each other. By comparing the two sets of classes to each other, we will uncover if the group memberships reflecting different

patterns among the social cognitive variables are related to group memberships in behavioral trajectories. For example, a combination of social cognitive factors that indicate favorability toward mindfulness practice could be related to a sharply increasing mindfulness practice. In addition, we will examine whether the classes are related to mental health (i.e., externalization and internalization of difficulties, resilience, and depressive systems) and practice outcomes. Certain groups may be seen to have benefited more while other groups may be seen to need another approach. In Finland, there may also be certain cultural groups to whom mindfulness practice is more acceptable and others to whom cultural relevance is lacking. Mindfulness has its roots in Eastern culture, but it has been adapted to and adopted by certain sections of Western culture; its practitioners are more likely to be white, female, middle-aged, and college-educated (Burke et al., 2017). Morever, girls have also sometimes reported experiencing benefits more than boys (Kang et al., 2018; Anonymous, 2020). Germane previous research has not found many gender differences in mindfulness practice behavior (Anonymous, 2020); however, analyses of social cognition and practice trajectory classes may display gender differences.

2. Methods

2.1. Participants

Participants were 1646 twelve-to fifteen-year-olds (49% girls; 51% boys), who took part in a mindfulness intervention. Finnish-speakers (i. e., those who only reported Finnish as their native language), comprised 79% of the sample. Swedish-speakers (i.e., those who reported Swedish or both Swedish and Finnish as their native language(s)), comprised 15% of the sample. Other-native-language-speakers (i.e., those who reported another native language other than or in addition to Finnish or Swedish), comprised 6% of the sample. As other language speakers were less than 0.1% in 1900, the 6%of other-native-language speakers today largely represent relatively recent immigrants and descendants of immigrants (*Väestö | Tilastokeskus*, 2018). Differences between Finnish- and Swedish-speaking Finns have been discussed in a variety of areas including social capital, health, socio-economic status, intelligence, personality, and senses of mastery and coherence (Dutton et al., 2016; Hyyppä and Mäki, 2001; Reini and Nyqvist, 2017; Sjöholm, 2004; Suominen et al., 2000; Volanen et al., 2006). A higher proportion of Swedish-speakers were gathered in this sample than in the population at large to study any differences there may be between Swedish- and Finnish-speakers.

2.2. Procedure

Please see Table 1 for a step-by-step guide to using latent profile analyses as a tool in conducting process evaluations and Table 2 for different kinds and examples of research questions. The data is from a cluster-randomized controlled trial, which took place in southern Finnish schools from 2014 to 2016. This cRCT consisted of three arms, an active experimental arm, which was taught mindfulness exercises, an active control arm, which was taught relaxation exercises, and a passive control arm, which was not given treatment but put on a waiting list. This study only uses data from the mindfulness arm. The intervention consisted of nine 45-min lessons once a week. The present study analyses data at baseline and post-intervention at 10 weeks and 26 weeks. The participants were recommended to practice at home 5–6 times per week, 3–15 min each time. The study plan was reviewed by the University of Helsinki Ethical Review Board in the Humanities and Social and Behavioral Sciences (1/2014). More information on the trial can be found in the trial protocol (Anonymous, 2016).

2.3. Measures

The six-item measure of outcome expectations concerning

Table 1
How to use latent profile analyses to identify distinct response classes.

Steps	Multi-Component Response Classes	Longitudinal Trajectories
Step 1. Think of research questions and what responses would be most pertinent to analyze. It may be helpful to choose a fitting motivation and behavior change theory.	Motivation and behavior change theories outline what factors to measure in order to find out how participants are perceiving and reacting to the intervention. For example, you may want to investigate classes of various components of motivation or longitudinal trajectory classes of intention. Different motivation and behavior change theories may be more appropriate than others to the intervention in question.	
	A theory that includes several components of response is suitable for a multi-component response class analysis (e.g. motivational classes from the Self-Determination Theory or the Reasoned Action Approach. Identify a framework and theory of psychological constructs. It is also possible to follow classes over time and see if they transition (see Emm-Collison et al. (2020)).	If the question of interest includes how a factor (e. g., the target behavior of interest or motivation) changes over time, it is possible to discover whether the sample consists of classes with different latent trajectories.
Step 2. Consider pre-registering hypotheses.	Consider pre-registering hypotheses about the number and composition of classes and what analyses with what variables will be done afterwards to find out more about the classes.	
Step 3. Measure responses to the intervention.	How and when will responses to the intervention be measured? Decide on the most appropriate time point(s) to measure the response and what is the best way to measure it.	
Step 4. Conduct latent profile analyses.	Once there is data on the responses to the intervention, run several latent profile analyses with different numbers of classes. For guidance in conducting latent profile analyses see, e.g., Nylund-Gibson and Choi (2018).	
Step 5. Decide on the number of classes.	Based on the goodness of fit indices (e.g., SABIC, VLMR-LRT p-values, and entropy) and graph interpretability decide on the optimal number of classes. Do the goodness of fit indices point to a certain number of classes? Do certain numbers of classes contain very small classes? Which numbers of classes contain the most meaningful and informative classes? For further guidance regarding deciding the optimal number of latent groups, please see, e.g., Nylund-Gibson and Choi (2018) and Lubke and Muthén (2005).	
Step 6. Learn from the distinct classes.	What do the distinct classes suggest? Do some groups perceive the intervention more favorably than others, for example? Is classe membership associated with other variables of interest, e.g., demographic variables?	Are there different longitudinal trajectories or do participants generally follow the same trajectory? How large is the group with the "optimal" change trajectory? If there are different trajectory groups, is their membership associated with other variables of interest?

mindfulness practice was separated into negative and positive domains. Injunctive norms were measured by the perceived friends' and parents' acceptability of the respondent engaging in the mindfulness exercises. Descriptive norms were measured by perceived friends' practice behavior. Self-efficacy was measured by the perceived ability to calm the mind during different stressful situations. These social cognitive variables were measured approximately a week after the intervention ended at 10 weeks from baseline. Practice was measured by a single item available at baseline and at the follow-ups. This item, "I do a mindfulness exercise", was in a list of possible activities to relax. Possible

Example research questions for intervention evaluations with latent profile analyses.

		Latent Profile Analyses Options	
		Cross-sectional classes	Longitudinal classes
Responses to the intervention	Mediating variables	Can participants be classified in terms of a certain set of mediating constructs, and how large are these groups? (E.g., see Fig. 1)	Can participants be classified by distinct longitudinal trajectories of a mediating variable, and how large are these groups? (E.g., how intention develops over time)
	Target(s)	Can participants be classified in terms of multiple behaviors that the intervention targets, e.g. nutrition, smoking and physical activity? How large are these groups?	Can participants be classified by distinct longitudinal trajectories of a target variable, and how large are these groups? (E.g., see Fig. 2)

responses were "Not at all", "Seldom", "Sometimes", and "Often". All measures including gender and native language were self-reported. Depressive symptoms were measured by a short form of Beck's Depression Inventory, resilience by a short version of the Resilience Scale, and externalization and internalization by the Strengths and Difficulties Questionnaire.

Please see Table 3 for more details including the number of available data points for each variable.

2.4. Statistical analyses

For those familiar with latent class analyses, latent profile analyses are essentially the same, another type of finite mixture modeling, with the main distinction being continuous rather than categorical indicator/ manifest variables (Masyn, 2013). Seven latent profile analyses were conducted for the social cognitive variables and seven for the practice variables with guidance from Nyland-Gibson and Choi (2018). The goodness of fit indices were BIC, AIC, and SABIC (lower meaning more superior fit), BLRT and VLMR-LRT p-values (a non-significant p-value meaning k-1 classes is a better fit), and entropy (>0.8, and the higher the better). The analyses used full information maximum likelihood estimation with robust standard errors. The latent profile analyses were conducted using Mplus Version 7 (Muthén & Muthén, Los Angeles, CA, USA).

Chi-square tests investigated associations between linguocultural group and gender and social cognitive and practice classes. The magnitude of Cramer's V effect sizes was gathered from Cohen (1988). Standardized residuals over ± 2.58 ($p < .01$) were chosen as the significance cut-off, because of the large sample size. Descriptive statistics and chi-square tests were calculated with IBM SPSS Statistics 25 (IBM Corp., Armonk, NY, USA).

Finally, longitudinal multilevel models were used to test for associations between the classes and mental health and practice outcomes, while taking possible higher-level effects into account. First, intraclass correlations were calculated to check how many levels to include in the models according to guidance from Field (2005) and (UCLA: Statistical Consulting Group, n. d.), and Barlett's and Levene's tests of equality of variances assessed if the assumption of homogeneity was met. Variables that did not meet the assumption of homogeneity were transformed and tested again. Then nine sets of models using full information maximum likelihood estimation were run for the combinations of classes and mental health and practice outcomes with guidance from Kwok et al. (2008), IBM SPSS (2021), and Field (2018). Each analysis included a class set (practice or social cognitive) as a predictor and mental health or

practice as an outcome with three time points. The multilevel models were run using IBM SPSS Statistics 26 (IBM Corp., Armonk, NY, USA). Due to the large sample size and multiple comparisons, we chose a *p*-cutoff of .01.

3. Results

3.1. Identifying the subgroups: latent profile analyses

Five-class solutions were found to be the best fit for both latent profile analyses. See Tables A1-A2 for fit indices. Although fit indices did not clearly demarcate the number of classes for either analysis, we chose five-class solutions based on group distinction as seen in the graphs. It would have been possible to choose latent class solutions with different numbers of classes. The solutions chosen were however supported by many of the indicators and revealed solutions that included classes with at least 4% of the sample and distinct groups. For example, with a four-class solution, the social cognitive classes did not include a "Disinclined" class and the four classes showed similar levels and trends. However, the five-class solution produced a distinct group with unfavorable social cognition towards mindfulness. More classes only decreased class size and did not add to the interpretability of the groups.

The five classes for social cognitions about mindfulness practice were (Research Question (RQ) 1a): Uncertain but Positive (40.2%; these were mostly positive about mindfulness practice but did not intend to practice), Acceptable but No (18.8%; these thought that mindfulness practice was socially acceptable but otherwise thought more negatively about mindfulness practice), Indifferent (16.8%; these had the most moderate cognition about mindfulness practice), Inclined (15.5%; these were the most positive about mindfulness practice), and Disinclined (8.6%; these thought the most negatively about mindfulness practice). The five classes for practice were (RQ 1b): Stable Low (52.1%), Decreased from Seldom (25.8%), Decreased from Sometimes (10.7%), Increased from Zero (6.8%), and Increased from Seldom (4.6%). See Figs. 1 and 2 for the mean levels of each class on each of the relevant variables.

3.2. Associations with other variables: chi-square tests

Next these social cognitive and practice classes were tested for associations with chi-square tests. There was a small-medium significant association between social cognitive class and native language χ^2 (8) = 59.29, $p < .001$, $V = 0.17$. Examining the specific group differences, standardized residuals were significant at $p < .01$ for three combinations. Native Swedish speakers were more likely to belong to the "Acceptable but No" social cognitive class, which has low intention and thought that mindfulness practice was acceptable but not very worthwhile and not commonly practiced among their friends (Standardized Residual = 4.0; OR = 2.42). Native other-language-speakers were less likely to belong to the "Indifferent" social cognitive class (Standardized Residual = −2.6; OR = 0.16) and more likely to belong to the "Inclined" social cognitive class (Standardized Residual = 4.8; OR = 3.97). More details are shown in Table 4.

There was also a small-medium significant association between practice trajectory class and native language χ^2 (8) = 39.75, $p < .001$, $V = 0.13$. Examining the specific group differences, standardized residuals were significant at $p < .01$ for two combinations. Native other-language-speakers were less likely to belong to the "Stable Low" practice class (Standardized Residual = −2.8; OR = 0.35) and more likely to belong to the "Decreased from Sometimes" practice trajectory class (Standardized Residual = 3.9; OR = 3.12). There were small-medium significant associations overall between social cognitive class and gender χ^2 (4) = 30.79, $p < .001$, $V = 0.16$ and practice trajectory class and gender χ^2 (4) = 19.19, $p = .001$, $V = 0.12$. However, there were no specific group differences. See Table 5 for more details. (RQ 2a)

Finally, there was also a significant association between social cognitive class and practice trajectory class χ^2 (16) = 56.01, $p < .001$, V

Table 3
Descriptions of the measures used.

Measures	Time Point (week)	*N*	*M* (SD)	Skew	Kurtosis	Type of Score	No. of Items	Example	Type of Scale	Reference	α
Positive Outcome Expectations	10	944	3.72 (0.86)	−0.75	0.86	Mean Score	4	The ability to relax and calm my mind when I'm stressed. nervous or anxious … Can help me feel better.	5-point Likert Scale from 1. "Totally disagree" to 5. "Totally agree" An additional "I don't know" response was excluded.	Francis et al. (2004)	.807
Negative Outcome Expectations	10	977	2.39 (1.06)	0.36	−0.55	Mean Score	2	The ability to relax and calm my mind when I'm stressed. nervous or anxious … Takes time from other important things	5-point Likert Scale from 1. "Totally disagree" to 5."Totally agree"	Francis et al. (2004)	.851
Self-efficacy	10	1132	2.96 (0.61)	−0.39	0.61	Mean Score	4	I think I can calm my mind. even when … I am stressed or in a bad mood.	4-point Likert Scale from 1. "I am certain I cannot" to 4. "I am certain I can"	Francis et al. (2004)	.833
Injunctive Norms	10	1111	3.68 (1.04)	−0.54	0.03	Mean Score	2	My parents think it is OK that I do the home exercises	5-point Likert Scale from 1. "Totally disagree" to 5. "Totally agree"	Francis et al. (2004)	.862
Descriptive Norm	10	1127	2.46 (1.10)	0.05	−0.90	Single Item	1	My friends do some of the exercises we learned	5-point Likert Scale from 1. "Totally disagree" to 5. "Totally agree"	Francis et al. (2004)	NA
Intention	10	1131	3.55 (1.88)	−0.01	−1.19	Single Item	1	During the next months. I will use the exercises I have learned to relax and calm my mind	7-point Likert Scale from 1. "Totally disagree" to 7. "Totally agree"	Francis et al. (2004)	NA
Use of a Mindfulness Exercise to Relax	0	1171	1.54 (0.73)	1.24	0.92	Single Item	1	How often do you do one of the following activities to relax? … 4. I do a mindfulness exercise	4-point Likert Scale from 1. "Not at all" to 4. "Often"	Original	NA
	10	1127	1.82 (0.86)	0.75	−0.29						
	26	932	1.60 (0.83)	1.23	0.60						
Externalization	0	1223	5.53 (3.24)	0.64	0.18	Sum Score (Range: 0-20)	10	I am often accused of lying or cheating.	3-point Likert Scale from 0. "Not true" to 2. "Certainly true"	Strengths & Difficulties Questionnaire (SDQ; (Goodman, 2015; Goodman et al., 2010; Koskelainen et al., 2000)	.730
	10	1164	5.33 (3.34)	0.54	−0.33						.753
	26	956	5.11 (3.24)	0.60	−0.26						.743
Internalization	0	1223	4.86 (3.35)	0.82	0.50	Sum Score (Range: 0-20)	10	I have many fears. I am easily scared.	3-point Likert Scale from 0. "Not true" to 2. "Certainly true"		.740
	10	1164	4.74 (3.47)	0.78	−0.01						.760
	26	955	4.68 (3.51)	0.81	0.12						.776
Depressive Symptoms	0	1162	2.17 (4.02)	3.57	17.06	Sum Score (Range: 0-36)	12	How are you feeling?	5 varying multiple choice answers corresponding to each question	Short form of Beck's Depression Inventory (BDI) (Kaltiala-Heino et al., 1999)	.878
	10	1120	1.93 (3.91)	3.79	18.74						.875
	26	934	1.80 (3.65)	3.85	20.74						.859
Resilience	0	1228	77.09 (11.35)	−0.93	1.93	Sum Score (Range: 14-98)	14	My life has meaning.	7-point Likert Scale from 1. "Disagree strongly" to 7. "Agree strongly"	The short version of the Resilience Scale (RS-14) (Losoi et al., 2013)	.877
	10	1175	76.86 (12.15)	−0.75	1.15						.904
	26	966	77.22 (13.17)	−1.27	3.31						.911

= 0.11. Inspecting the specific group differences, three combinations were significant at p < .01. The "Acceptable but No" social cognitive class was less likely to overlap with the "Decreased from Sometimes" practice trajectory class (Standardized Residual = −2.9; OR = 0.28) than expected and more likely to overlap with the "Stable Low" trajectory class (Standardized Residual = 3.1; OR = 2.32). The last combination was that the "Inclined" social cognitive class was more likely to overlap with the "Decreased from Sometimes" practice trajectory class (Standardized Residual = 3.2; OR = 2.35). (RQ 2b) More details are shown in Table 6. Due to the missing data in our dataset, we conducted sensitivity analyses using multiple imputation in SPSS to check our results. Although there are some slight changes in the significance levels of the individual subgroup associations, the trends are the same, and all the chi-square statistics remained significant. Please see Table A3 for the chi-square statistics.

3.3. Multilevel models

The intraclass correlations (Table A4), which informed how many levels each analysis had, and the stages of the multilevel models

Table 4
Crosstabulation of Social Cognitive Classes with Linguocultural Group (n=1074) and Gender(n=1156)

		Disinclined	Acceptable but No	Uncertain but Positive	Indifferent	Inclined
		Observed (Expected) SR Row %	Observed (Expected) SR %	Observed (Expected) SR %	Observed (Expected) SR %	Observed (Expected) SR %
Linguocultural Group	**Finnish**	65 (63)	154 (170)	353 (345)	158 (143)	120 (129)
		0.2	-1.2	0.4	1.3	-0.8
		7.6%	18.1%	42.5%	18.6%	14.1%
	Swedish	13 (12)	55 (32)	55 (66)	20 (27)	19 (25)
		0.3	4.0*	-1.3	-1.4	-1.1
		8.0%	34.0%	34.0%	12.3%	11.7%
	Other	2 (5)	6 (12)	28 (25)	2 (10)	24 (9)
		-1.2	-1.8	0.6	-2.6*	4.8*
		3.2%	9.7%	45.2%	3.2%	38.7%
Gender	**Girls**	29 (44)	138 (118)	241 (245)	115 (98)	72 (90)
		-2.2	1.8	-.3	1.7	-1.9
		4.9%	23.2%	4.5%	19.3%	12.1%
	Boys	56 (41)	92 (112)	235 (231)	75 (92)	103 (85)
		2.3	-1.9	.3	-1.8	2.0
		10.0%	16.4%	41.9%	13.4%	18.4%

Note. Observed and expected frequencies, standardized residuals (SR), and percentages (%; by row). * p < .01 (standardized residuals over ± 2.58). Expected values have been rounded.

Table 5
Crosstabulation of Practice Trajectory Classes with Linguocultural Group (n = 1214) and Gender (n = 1315).

		Decreased from Seldom	Stable Low	Decreased from Sometimes	Increased from Zero	Increased from Seldom
		Observed (Expected) SR Row %	Observed (Expected) SR %	Observed (Expected) SR %	Observed (Expected) SR %	Observed (Expected) SR %
Linguocultural Group	Finnish	248 (251)	551 (529)	84 (110)	45 (47)	31 (32)
		−0.2	1.0	−1.6	−0.3	−0.1
		25.9%	57.5%	8.8%	4.7%	31.6%
	Swedish	50 (47)	94 (98)	24 (19)	7 (9)	3 (6)
		0.5	−0.4	1.2	−0.6	−1.2
		28.1%	52.8%	13.5%	3.9%	1.7%
	Other	20 (20)	24 (42)	19 (8)	8 (4)	6 (3)
		0.0	−2.8*	3.9*	2.2	2.2
		3.2%	9.7%	45.2%	3.2%	38.7%
Gender	Girls	165 (160)	394 (374)	54 (66)	32 (35)	9 (20)
		0.4	1.1	−1.4	−0.6	−2.4
		25.2%	60.2%	8.3%	4.9%	1.4%
	Boys	156 (161)	357 (378)	78 (66)	39 (36)	31 (20)
		−0.4	−1.1	1.4	0.6	2.4
		23.6%	54.0%	11.8%	5.9%	4.7%

Note. Observed and expected frequencies, standardized residuals (SR), and percentages (%; by row).
*p < .01 (standardized residuals over ± 2.58). Expected values have been rounded.

Table 6
Crosstabulation of Social Cognitive Classes with Practice Trajectory classes (n = 1153).

	Decreased from Seldom	Stable Low	Decreased from Sometimes	Increased from Zero	Increased from Seldom
	Observed (Expected) SR Row %	Observed (Expected) SR %	Observed (Expected) SR %	Observed (Expected) SR %	Observed (Expected) SR %
Disinclined	14 (21)	52 (49)	8 (8)	7 (5)	4 (3)
	−1.6	0.4	0.2	1.1	0.8
	16.5%	61.2%	9.4%	8.2%	4.7%
Acceptable but No	44 (57)	167 (132)	7 (20)	9 (13)	2 (7)
	−1.7	3.1*	−2.9*	−1.0	−2.0
	19.2%	72.8%	3.1%	3.9%	0.9%
Uncertain but Positive	127 (118)	262 (273)	45 (42)	26 (26)	15 (15)
	0.8	−0.7	0.5	−0.1	−0.1
	26.7%	55.2%	9.5%	5.5%	3.2%
Indifferent	59 (47)	102 (109)	14 (17)	10 (11)	5 (6)
	1.7	−0.7	−0.7	−0.2	−0.4
	31.1%	53.7%	7.4%	5.3%	2.6%
Inclined	43 (43)	80 (100)	28 (15)	12 (10)	11 (6)
	0.0	−2.0	3.2*	0.8	2.3
	24.7%	46.0%	16.1%	6.9%	6.3%

Note. Observed and expected frequencies, standardized residuals (SR), and percentages (%; by row).
*p < .01 (standardized residuals over ± 2.58). Expected values have been rounded.

(Tables A5-A13) can be found in the supplementary materials online. Some variables did not pass Bartlett's or Levene's tests of homogeneity of variance, and they were transformed and tested for improved homogeneity of variance. Therefore, some stages of the models include transformed variables. The social cognitive classes were significantly related to externalization ($n = 1157$; $F (4, 1137.9) = 5.96$, $p < .001$), depressive symptoms ($n = 1145$; $F (4, 1100.2) = 6.50$, $p < .001$), resilience ($n = 1157$; $F (4, 1142.1) = 9.21$, $p < .001$), and practice ($n = 1145$; $F (4, 1975.0) = 52.22$, $p < .001$) but were not significantly related to internalization ($n = 1157$; $F (4, 1142.0) = 1.64$, $p = .162$). The practice trajectory classes were not significantly related to externalization ($n = 1316$; $F (4, 1251.3) = 1.73$, $p = .142$), internalization ($n = 1316$; $F (4, 1254.8) = 1.60$, $p = .172$), depressive symptoms ($n = 1217$; $F (4, 3201.0) = 0.41$, $p = .803$), or resilience ($n = 1316$; $F (4, 1272.0) = 1.10$, $p = .356$). The fixed effects are shown in Table A14 and the covariance parameters are in the supplementary materials (Tables A15-A16). Figs. 3–4 show the estimated marginal mean levels of externalization, internalization, depressive symptoms, resilience, and practice. As indicated by the figures, there were not significant differences in externalization among the social cognitive or practice trajectory classes except for the "Disinclined" social cognitive class, which had higher externalization symptoms. For internalization, there were no significant differences among the social cognitive or practice trajectory classes. For depressive symptoms, there were no significant differences among the social cognitive or practice trajectory classes except for the "Disinclined" social cognitive class, which had significantly higher depressive symptoms than all the other classes except the "Indifferent" class. For resilience, there were only four significant differences: The "Disinclined" class was significantly less resilient than the "Acceptable but No" and "Inclined" classes, and the "Inclined" class was significantly more resilient than the "Indifferent" and "Uncertain but Positive" classes. (RQ 2c) For practice (RQ 2d), the "Inclined" class practiced the most, the "Uncertain but Positive" class practiced the second most, the "Disinclined" and "Indifferent" classes practiced the third most, and the "Acceptable but No" class practiced the least. Figure A1 shows the raw means of the mental health and practice variables across time by social cognitive class, and Figure A2 shows them by practice trajectory class.

4. Discussion

4.1. Summary of results

This study set out to use latent profile analysis to uncover a possible variety of participant responses within a mental health promotion trial. We found types of participants who differed in their patterns of social cognitions and practice frequencies. These types evince a more nuanced picture of intervention acceptability and engagement than the overall

means gave. Contributing to a process evaluation as recommended by Moore et al. (2015), related previous research investigated mechanisms of impact (Anonymous, 2019, 2020), while the current study extends that research by showing how some contextual factors (i.e., in subgroup differences), can be disentangled and advance our understanding of *for whom* an intervention works. There were for instance groups of participants who were inclined towards mindfulness practice, disinclined, and those who were otherwise disinclined, but who thought that mindfulness practice was socially acceptable. In the practice trajectory classes, there was no group who practiced mindfulness often at any time point, but there were those who, starting from different points, decreased, increased, or did not change much. These different patterns in social cognition and behavioral trajectories could not be seen in our previous research of overall means; they demonstrate how latent profile analyses can shine a light on different types of responses. Further analyses showed some associations among these types and demographic factors.

The first latent profile analysis revealed five social cognitive classes. The largest group was the "Positive but Uncertain" class who leaned towards thinking of mindfulness practice positively (across all sets of beliefs/cognitions), but did not intend to practice. They may need a little longer intervention to tip them towards intention to practice. The second largest group, the "Acceptable but No" class, was distinct in that while they strongly disagreed that their friends were practicing, they also agreed that their friends and parents approve of practice more than most other classes. For them, injunctive norms would not be important to target, but descriptive norms would be. The third largest group, the "Indifferent" class, had levels of descriptive norms and intention *in* between those of the other classes, but they still disagreed that their friends were practicing and that they would intend to practice themselves. They may also benefit from a longer intervention that is attentive to their feedback. The "Inclined" class was the only class that actually intended to practice mindfulness. For them, support in bridging the gap between intention and practice behavior may be the highest priority. The smallest group, the "Disinclined" class, had the most negative social cognitive response and may need a significant overall change in approach the most. Descriptive norms were the concept that differed the most between groups. They were also the strongest predictor of intention to practice mindfulness in past research (Anonymous, 2020; Anonymous et al., 2019).

The second profile analysis with practice trajectories also revealed five classes. The largest class was the "Stable Low", comprising more than half the participants. They started off with no practice and then practiced less than seldom after the intervention. The next largest group at around a quarter of the participants practiced seldom before the intervention and decreased their practice. The third largest group practiced sometimes before the intervention and then decreased to seldom practice by 26 weeks. This pattern shows that there were some
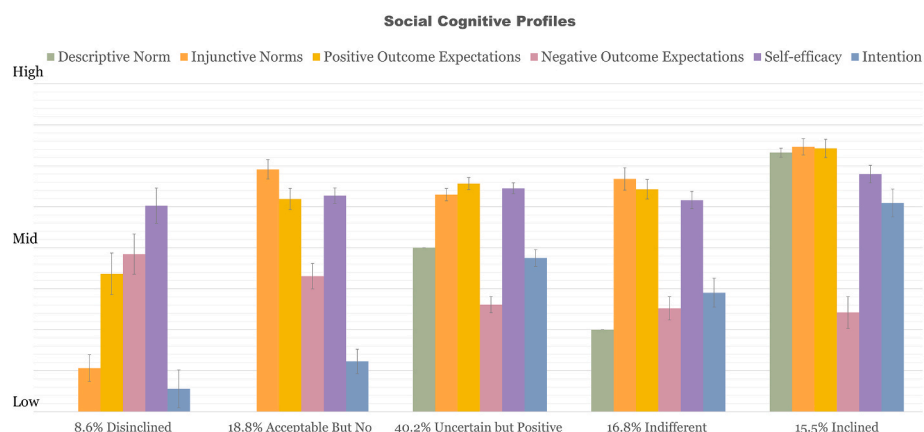

Fig. 1. Social cognitive classes based on a latent profile analysis. *Note.* Each variable was divided by the number of points on its scale. 95% CI. $N = 1157$.
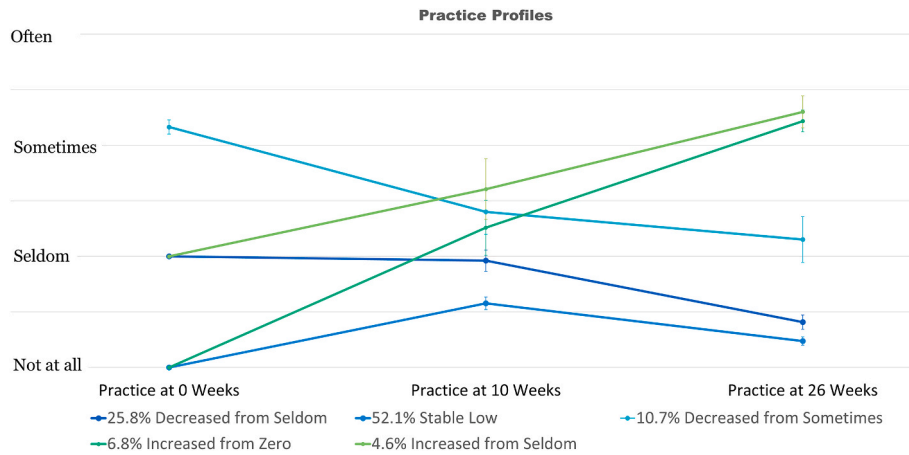
Fig. 2. Practice Classes based on a latent profile analysis. *Note.* 95% CI. N = 1316.
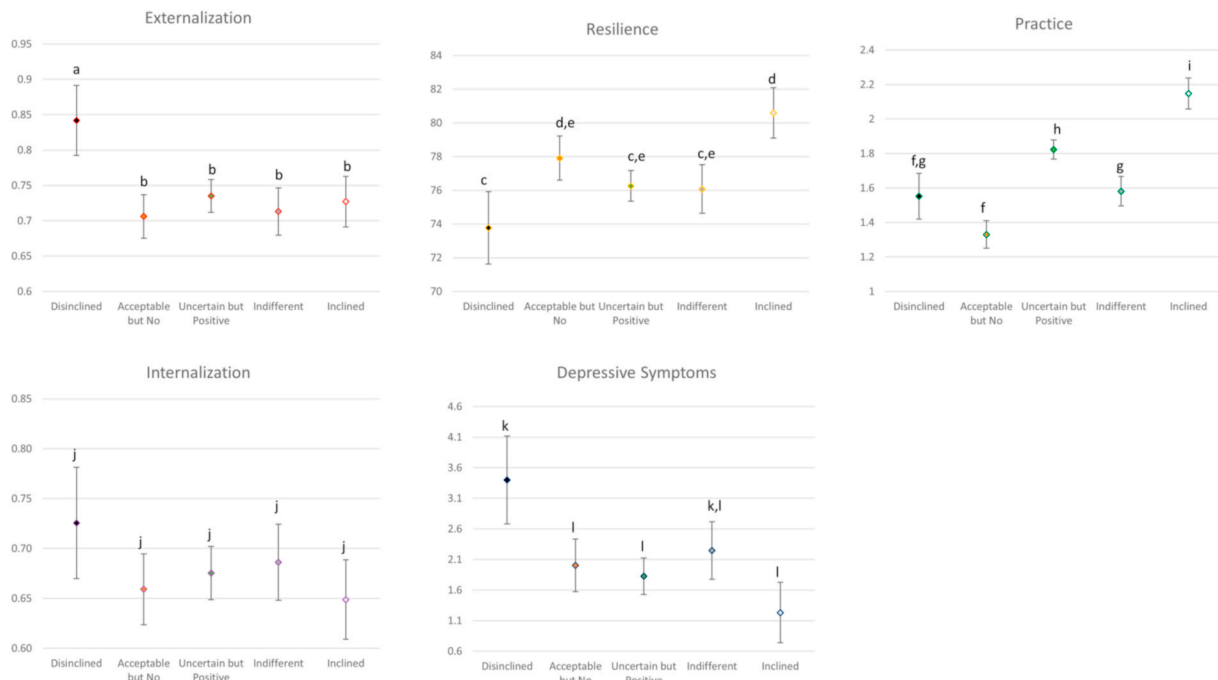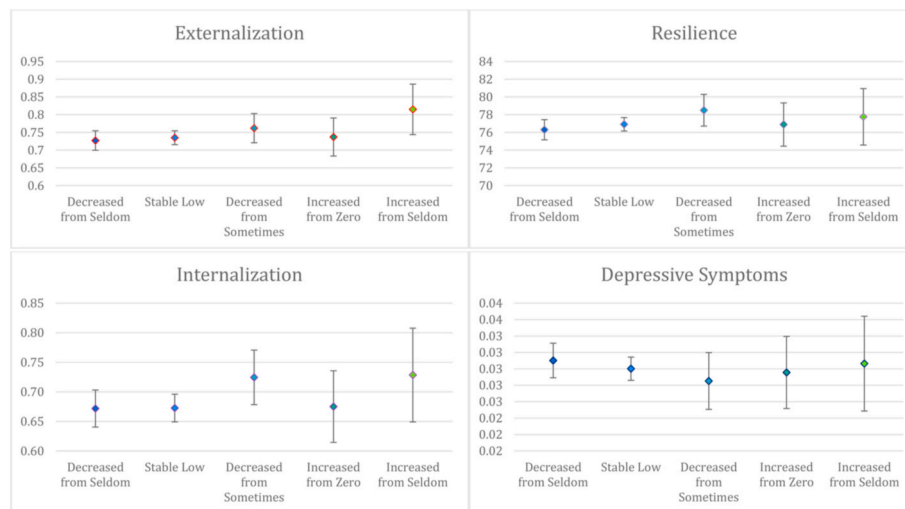

Fig. 3. Estimated Marginal Means of Mental Health by Social Cognitive Class with 95% CIs. *Note.* Estimated Marginal Means with 95% CI's calculated at approximately eleven weeks with mental health and seventeen weeks with practice. Letter pairs denote pairwise comparisons between classes which are **not** significantly different at $p \leq .01$.

participants reporting doing some kind of mindfulness exercises before the intervention. There could be a number of reasons that their self-reported practice decreased. They could have been practicing different mindfulness exercises before the intervention when they completed the baseline survey. After the intervention taught them new mindfulness exercises, they thought that the survey was not enquiring about their old mindfulness exercises and so they reported less practice than before. Alternatively, they could have been deterred from practicing by discovering that their friends are not practicing or that they do not approve of mindfulness practice. The fourth largest group increased their practice from never to sometimes by 26 weeks. The fifth and smallest group practiced seldom before the intervention and increased their practice to sometimes by 26 weeks as well. These last groups, increasers, can be considered the most successful groups, and it may be worthwhile to investigate the factors in their success further (e.g., through qualitative interviews). Looking more generally, the group that did not change much amounted to 52.1% of the sample, the decreasers

comprised 36.5% of the sample, and the increasers (the two latter groups) comprised 11.4% of the sample.

When investigating the associations between the classes and other variables of interest, some statistically significant associations were found, all small to medium in effect size. For example, with regard to linguocultural differences, those whose native language was neither Finnish nor Swedish (i.e., largely those with immigrant backgrounds) were more inclined towards mindfulness practice and practiced mindfulness more. Swedish-speaking Finns, while disinclined towards mindfulness practice, stood out as differentiating strongly between the social acceptability of mindfulness practice and the amount their friends practiced. This finding may reflect the importance of descriptive norms especially for Swedish-speaking Finns who have been found to have higher social capital and social effectiveness (Dutton et al., 2016; Hyyppä and Mäki, 2001). The associations between the classes suggested that high injunctive norms and positive outcome expectations are not enough to be among those who practice, but high descriptive norms

Fig. 4. Estimated Marginal Means of Mental Health by Practice Trajectory class with 95% CIs. *Note.* Estimated Marginal Means with 95% CI's calculated at approximately eleven weeks. Depressive symptoms are reciprocal transformed in this practice trajectory classes graph but not in the earlier social cognitive classes graph. No significant differences were found.

and intention are necessary as well.

Finally, mental health outcomes and practice classes were not associated, but there were significant associations between some of the mental health and practice outcomes and the social cognitive classes. The "Disinclined" social cognitive class had worse mental health outcomes. Those who are disinclined to practice mindfulness may need extra attention to their mental health. The associations between the social cognitive classes and practice were mostly as to be expected, with the "Inclined" class practicing the most.

4.2. Strengths and limitations

A key strength of this study is the large sample of a cluster-RCT. It adds to the current literature by showing how latent profile analyses can be used to investigate whether there are distinct classes of participants who differ by social cognitive and behavioral responses to an intervention introducing a novel behavior—mindfulness practice.

Nonetheless, there are limitations. The measures used could be improved by following Ajzen's (2002) guidelines and referring more precisely to the target behavior. The measures of self-efficacy and outcome expectations, in particular, refer to the ability to calm the mind in certain situations, rather than to the ability to perform mindfulness exercises. Another measure with limitations is the mindfulness practice measure. At baseline, participants may not have understood the item about mindfulness practice if they had never heard of mindfulness practice before. According to the program developers, mindfulness was a relatively unknown concept in Finland and especially in schools. Another limitation relates to dropout and missing data: Overall, there were 1646 participants who took part in a mindfulness intervention, but as can be seen in Table 3, the number varies between 932 and 1228, with the amount of missing data increasing at later time points. Past analyses of the missing data in this sample found baseline differences in grade level, internalization, and externalization, but none in gender, resilience, and depressive symptoms (Anonymous, 2020). Finally, the sample of other-language speakers could have been larger to make the findings more robust.

4.3. Practice and policy implications

Using classes for tailoring interventions represents a step towards more targeted intervention delivery, which is a method conducive to personalizing healthcare (Cloutier-Bergeron et al., 2019). They may be

particularly suitable when an individualized approach is not feasible, which may very well be the case in many school-based mindfulness interventions. The exploration of response subgroups can inform intervention developers of different tailoring needs in their intervention. While other analyses can also provide useful information, response types from latent profile analyses can reveal a different kind of information compared to overall averages; response types show subgroup patterns. Analyzing the classes is useful for seeing how a cultural group, for example, may be more likely to show a certain pattern in the variables, a certain mental landscape. Gaining this information is one step toward making mindfulness interventions more culturally relevant, which Tenfelde et al. (2018) elucidated is needed. In addition, a group that is more inclined towards mindfulness practice and practices more could make excellent peer educators. In our sample, we found that those with an immigrant background were more inclined towards mindfulness practice; this result implies that the role of peer educator could potentially be a small source of empowerment for those with an immigrant background. However, the groups compared are different sizes; collecting larger samples of the minority groups would result in more robust findings. Clinical applicability of these findings is an open question until other studies corroborate similar results with effects that are clinically meaningful.

4.4. Future research

As this the current study was exploratory, we would expect more research to be needed to generalize and apply the current findings. Optimally, similar analyses would be conducted during another intervention so that the precise findings for that sample can be used to inform tailoring of that intervention. The classes themselves and how they can be used in process evaluations are the main outputs of this study. Future research could delve deeper into the classes (e.g., with qualitative interviews). In addition, intervention developers could test whether tailoring interventions for different social cognitive response groups is more effective. To accomplish this, intervention developers could find response groups in an initial intervention and then tailor secondary interventions. Tailoring could attend to several different aspects. For example, some participants may be already familiar with mindfulness practice and for others, it may be a new practice for which more attention to introduction may be necessary. For some, it may be socially acceptable, but trust that it is beneficial and worthwhile may be lacking. This trust could be built by hearing about friends' experiences and trying

it out oneself.

Future research in motivation to practice mindfulness, in particular, could investigate latent classes in social cognitive and engagement responses in other intervention studies or using other theories of behavioral change and motivation. Another approach to make use of the latent profile analysis would be to assess response classes very early on in the study, and not only after the intervention, to be better able to tailor activities, because baseline classes may predict intervention success (Saunders et al., 2016; Tanaka and Nolan, 2018; Uckelstam et al., 2019). For those interested in how intervention responses can be predicted, Kaplan et al. (2010) demonstrate how potential for outcomes can be measured. Furthermore, prior experience with mindfulness practice and additional demographic factors, such as socioeconomic status (Finegan et al., 2018; Kivimäki et al., 2020) and religion/spiritual beliefs (Palitsky and Kaplan, 2019) could be analyzed for associations with the classes.

It is interesting that the practice trajectory classes were not related to mental health. One reason may be that the two classes (only 11.4%) that increased their practice to "sometimes" still did not practice enough to enhance their well-being. Future research could disentangle the relevance of mindfulness practice trajectory type/class by utilizing different measures and aspects of mental health. For example, more measures of positive mental health could be examined, such as self-kindness/compassion. High self-compassion may facilitate mindfulness practice as practitioners are more compassionate with themselves when their mind wanders and they bring their awareness back without self-chastisement. Therefore self-compassion may be associated with self-efficacy and attitudes toward mindfulness practice and stable high and increasing mindfulness practice trajectories. In addition, non-linear methods and more time points to get a more accurate picture of practice would all bolster the current research. Mindfulness itself may be a theoretical mediator of practice and any benefits, but as Rosch (2015) illustrates, the current mindfulness measures cannot measure mindfulness well: Respondents of self-report scales may answer according to their experience and knowledge rather than according to their level mindfulness. In addition, the self-report scales measure perhaps some other aspects of a healthy mind. It will certainly be interesting to see how future research on mindfulness and technological advances expand our knowledge of what is going on between practice and some outcomes. Moreover, it would be important to conduct qualitative studies to obtain a more profound understanding of what adolescents interpret mindfulness is.

This study only analyzed the social cognitive classes at one measurement time, post-intervention. It is however possible and likely that these social cognitive classes change over time, with only some of them being more stable (see, e.g., Emm-Collison (2020)). Future research could investigate what kind of social cognitive classes memberships are likely to persist over time. It could also reveal if similar classes and the same number of classes are found in the first place.

5. Conclusions

Theory combined with various methods such as latent profile analysis can shed light on different aspects of a research problem within a process evaluation (e.g., see Kostamo et al. (2019)), and find results that another method would not have. Going beyond the overall average of participant responses highlights diversity within intervention samples. In this study, the five social cognitive classes found were: low, moderate, and high social cognitions, high injunctive norms but otherwise disinclined to practice, and positive but uncertain about intending to practice. The practice trajectories consisted of two increasing, two decreasing, and one stable low trajectory. This study found group differences that have implications for intervention acceptability, engagement, and context.

Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.socscimed.2022.114748.

References

Ajzen, I., 2002. Constructing a TPB Questionnaire: Conceptual and Methodological Considerations. https://pdfs.semanticscholar.org/0574/b20bd58130dd5a961f1a2db10fd1fcbae95d.pdf?_ga=2.255171983.665812445.1578582672-800797.1578494621.

Ajzen, I., 2011. Behavioral interventions: design and evaluation guided by the theory of planned behavior. In: Social Psychology and Evaluation. Guilford Press, pp. 72–101.

Beattie, M., Hankonen, N., Konttinen, H., Volanen, S.M., 2022. Uptake of and motivational responses to mental health-promoting practices: Comparing receipt of relaxation and mindfulness interventions in two arms of the Healthy Learning Mind trial. [Manuscript submitted for publication]. Faculty of Social Sciences, University of Helsinki.

Beattie, M., Hankonen, N., Salo, G., Knittle, K., Volanen, S.-M., 2019. Applying behavioral theory to increase mindfulness practice among adolescents: An exploratory intervention study using a within-trial RCT design. Mindfulness 10(2), 312–324. https://doi.org/10.1007/s12671-018-0976-2.

Beattie, M., Konttinen, H.M., Volanen, S.-M., Knittle, K.P., Hankonen, N.E., 2020. Social cognitions and mental health as predictors of adolescents' mindfulness practice. Mindfulness. https://doi.org/10.1007/s12671-020-01331-8.

Burke, A., Lam, C.N., Stussman, B., Yang, H., 2017. Prevalence and patterns of use of mantra, mindfulness and spiritual meditation among adults in the United States. BMC Compl. Alternative Med. 17 (1), 1–18. https://doi.org/10.1186/s12906-017-1827-8.

Cloutier-Bergeron, A., Provencher, V., Mongeau, L., Paquette, M.-C., Carbonneau, É., Turcotte, M., Bégin, C., 2019. Does Health At Every Size® fit all? A group-based trajectory modeling of a non-diet intervention. Appetite 143, 104403. https://doi.org/10.1016/j.appet.2019.104403.

Cohen, J., 1988. Statistical Power Analysis for the Behavioral Sciences, second ed. Routledge. https://doi.org/10.4324/9780203771587.

Deaton, A., Cartwright, N., 2018. Understanding and misunderstanding randomized controlled trials. Soc. Sci. Med. 210, 2–21. https://doi.org/10.1016/j.socscimed.2017.12.005.

Demment, M.M., Graham, M.L., Olson, C.M., 2014. How an online intervention to prevent excessive gestational weight gain is used and by whom: a randomized

controlled process evaluation. J. Med. Internet Res. 16 (8), e194. https://doi.org/10.2196/jmir.3483.

Dutton, E., Van der Linden, D., Madison, G., Antfolk, J., Woodley of Menie, M.A., 2016. The intelligence and personality of Finland's Swedish-speaking minority. Pers. Indiv. Differ. 97, 45–49. https://doi.org/10.1016/j.paid.2016.03.024.

Emm-Collison, L.G., Sebire, S.J., Salway, R., Thompson, J.L., Jago, R., 2020. Multidimensional motivation for exercise: a latent profile and transition analysis. Psychol. Sport Exerc. 47, 101619. https://doi.org/10.1016/j.psychsport.2019.101619.

Erbe, R.G., Beckmeyer, J.J., Lohrmann, D.K., Middlestadt, S.E., 2019. Examining determinants of adolescents'intention to meditate. Am. J. Health Stud. 34 (1).

Erbe, R.G., Middlestadt, S.E., Lohrmann, D.K., Beckmeyer, J.J., 2018. A Salient Belief Elicitation Examining Adolescents' Meditation Beliefs Using the Reasoned Action Approach, vol. 1524839918811803. Health Promotion Practice. https://doi.org/10.1177/1524839918811803.

Field, A., 2018. Discovering Statistics Using IBM SPSS Statistics, fifth ed. SAGE.

Field, A.P., 2005. Intraclass correlation. In: Everitt, B.S., Howell, D.C. (Eds.), Encyclopedia of Statistics in Behavioral Science, vol. 2. John Wiley & Sons, pp. 948–954.

Finegan, M., Firth, N., Wojnarowski, C., Delgadillo, J., 2018. Associations between socioeconomic status and psychological therapy outcomes: a systematic review and meta-analysis. Depress. Anxiety 35 (6), 560–573. https://doi.org/10.1002/da.22765.

Francis, J., Eccles, M.P., Johnston, M., Walker, A.E., Grimshaw, J.M., Foy, R., Kaner, E.F., Smith, L., Bonetti, D., 2004. Constructing Questionnaires Based on the Theory of Planned Behaviour: A Manual for Health Services Researchers. Centre for Health Services Research, University of Newcastle upon Tyne.

Goodman, A., 2015. Scoring the SDQ. http://www.sdqinfo.com/py/sdqinfo/c0.py. May 11.

Goodman, A., Lamping, D.L., Ploubidis, G.B., 2010. When to use broader internalising and externalising subscales instead of the hypothesised five subscales on the Strengths and Difficulties Questionnaire (SDQ): data from British parents, teachers and children. J. Abnorm. Child Psychol. 38 (8), 1179–1191. https://doi.org/10.1007/s10802-010-9434-x.

Hagger, M.S., Cameron, L.D., Hamilton, K., Hankonen, N., Lintunen, T., 2020. The Handbook of Behavior Change. Cambridge University Press. https://doi.org/10.1017/9781108677318.

Hillhouse, J., Turrisi, R., Cleveland, M.J., Scaglione, N.M., Baker, K., Florence, L.C., 2016. Theory-driven longitudinal study exploring indoor tanning initiation in teens using a person-centered approach. Ann. Behav. Med. 50 (1), 48–57. https://doi.org/10.1007/s12160-015-9731-2.

Hyyppä, M.T., Mäki, J., 2001. Why do Swedish-speaking Finns have longer active life? An area for social capital research. Health Promot. Int. 16 (1), 55–64. https://doi.org/10.1093/heapro/16.1.55.

IBM, S.P.S.S., 2021. March 26). IBM SPSS Statistics Documentation. IBM. https://prod.ibmdocs-production-dal-6099123ce774e592a519d7c33db8265e-0000.us-south.containers.appdomain.cloud/docs/en/spss-statistics.

Kaltiala-Heino, R., Rimpelä, M., Rantanen, P., Laippala, P., 1999. Finnish modification of the 13-item Beck Depression Inventory in screening an adolescent population for depressiveness and positive mood. Nord. J. Psychiatr. 53 (6), 451–457. https://doi.org/10.1080/080394899427700.

Kang, Y., Rahrig, H., Eichel, K., Niles, H.F., Rocha, T., Lepp, N.E., Gold, J., Britton, W.B., 2018. Gender differences in response to a school-based mindfulness training intervention for early adolescents. J. Sch. Psychol. 68, 163–176. https://doi.org/10.1016/j.jsp.2018.03.004.

Kaplan, S.H., Billimek, J., Sorkin, D.H., Ngo-Metzger, Q., Greenfield, S., 2010. Who can respond to treatment?: identifying patient characteristics related to heterogeneity of treatment effects. Med. Care 48 (6 Suppl. l), S9. https://doi.org/10.1097/MLR.0b013e3181d99161.

Kivimäki, M., Batty, G.D., Pentti, J., Shipley, M.J., Sipilä, P.N., Nyberg, S.T., Suominen, S.B., Oksanen, T., Stenholm, S., Virtanen, M., Marmot, M.G., Singh-Manoux, A., Brunner, E.J., Lindbohm, J.V., Ferrie, J.E., Vahtera, J., 2020. Association between socioeconomic status and the development of mental and physical health conditions in adulthood: a multi-cohort study. Lancet Public Health 5 (3), e140–e149. https://doi.org/10.1016/S2468-2667(19)30248-8.

Koskelainen, M., Sourander, A., Kaljonen, A., 2000. The Strengths and Difficulties Questionnaire among Finnish school-aged children and adolescents. Eur. Child Adolesc. Psychiatr. 9 (4), 277–284. https://doi.org/10.1007/s007870070031.

Kostamo, K.H., Jallinoja, P., Vesala, K.M., Araujo-Soares, V., Sniehotta, F.F., Hankonen, N.E., 2019. Using the critical incident technique for qualitative process evaluation of interventions: the example of the "Let's Move It" trial. Soc. Sci. Med. 232, 389–397. https://doi.org/10.1016/j.socscimed.2019.05.014.

Kwok, O.-M., Underhill, A.T., Berry, J.W., Luo, W., Elliott, T.R., Yoon, M., 2008. Analyzing longitudinal data with multilevel models: an example with individuals living with lower extremity intra-articular fractures. Rehabil. Psychol. 53 (3), 370. https://doi.org/10.1037/a0012765.

Lorenc, T., Petticrew, M., Welch, V., Tugwell, P., 2013. What types of interventions generate inequalities? Evidence from systematic reviews. J. Epidemiol. Community Health 67 (2), 190–193. https://doi.org/10.1136/jech-2012-201257.

Losoi, H., Turunen, S., Wäljas, M., Helminen, M., Öhman, J., Julkunen, J., Rosti-Otajärvi, E., 2013. Psychometric properties of the Finnish version of the resilience scale and its short version. Psychol. Community Health 2 (1), 1–10. https://doi.org/10.5964/pch.v2i1.40.

Lubke, G.H., Muthén, B., 2005. Investigating population heterogeneity with factor mixture models. Psychol. Methods 10 (1), 21. https://doi.org/10.1037/1082-989X.10.1.21.

McEachan, R., Taylor, N., Harrison, R., Lawton, R., Gardner, P., Conner, M., 2016. Meta-analysis of the reasoned action approach (RAA) to understanding health behaviors. Ann. Behav. Med.: Publ. Soc. Behav. Med. 50 (4), 592–612. https://doi.org/10.1007/s12160-016-9798-4.

McKeering, P., Hwang, Y.-S., 2018. A systematic review of mindfulness-based school interventions with early adolescents. Mindfulness 1–18. https://doi.org/10.1007/s12671-018-0998-9.

Masyn, K.E., 2013. Latent class Analysis and finite mixture modeling. In: The Oxford Handbook of Quantitative Methods in Psychology, vol. 2. Oxford University Press, pp. 551–611.

Moore, G.F., Audrey, S., Barker, M., Bond, L., Bonell, C., Hardeman, W., Moore, L., O'Cathain, A., Tinati, T., Wight, D., Baird, J., 2015. Process evaluation of complex interventions: medical Research Council guidance. BMJ 350, h1258. https://doi.org/10.1136/bmj.h1258.

Nylund-Gibson, K., Choi, A.Y., 2018. Ten frequently asked questions about latent class analysis. Translat. Iss. Psychol. Sci. 4 (4), 440–461. https://doi.org/10.1037/tps0000176.

Palitsky, R., Kaplan, D.M., 2019. The role of religion for mindfulness-based interventions: implications for dissemination and implementation. Mindfulness 1–14.

Patrick, M.E., Maggs, J.L., 2010. Profiles of motivations for alcohol use and sexual behavior among first-year university students. J. Adolesc. 33 (5), 755–765. https://doi.org/10.1016/j.adolescence.2009.10.003.

Reini, K., Nyqvist, F., 2017. Sense of mastery differences between working-age Swedish- and Finnish-speaking Finns: a population-based study. Scand. J. Publ. Health 45 (4), 404–410. https://doi.org/10.1177/1403494817696183.

Rijbroek, B., Strating, M.M.H., Konijn, H.W., Huijsman, R., 2019. Child protection cases, one size fits all? Cluster analyses of risk and protective factors. Child Abuse Negl. 95, 104068. https://doi.org/10.1016/j.chiabu.2019.104068.

Rosch, E., 2015. The emperor's clothes: a look behind the Western mindfulness mystique. In: Handbook of Mindfulness and Self-Regulation. Springer, New York, NY, pp. 271–292.

Saunders, R., Cape, J., Fearon, P., Pilling, S., 2016. Predicting treatment outcome in psychological treatment services by identifying latent profiles of patients. J. Affect. Disord. 197, 107–115. https://doi.org/10.1016/j.jad.2016.03.011.

Shin, Y., Miller-Day, M., Pettigrew, J., Hecht, M.L., Krieger, J.L., 2014. Typology of delivery quality: latent profile analysis of teacher engagement and delivery techniques in a school-based prevention intervention, keepin' it REAL curriculum. Health Educ. Res. 29 (6), 897–905. https://doi.org/10.1093/her/cyu061.

Sjöholm, K., 2004. Swedish, Finnish, English? Finland's Swedes in a changing world. J. Curric. Stud. 36 (6), 637–644. https://doi.org/10.1080/0022027042000186600.

Stapleton, J., Turrisi, R., Hillhouse, J., Robinson, J.K., Abar, B., 2010. A comparison of the efficacy of an appearance-focused skin cancer intervention within indoor tanner subgroups identified by latent profile analysis. J. Behav. Med. 33 (3), 181–190. https://doi.org/10.1007/s10865-009-9246-z.

Suominen, S.B., Välimaa, R.S., Tynjälä, J.A., Kannas, L.K., 2000. Minority status and perceived health: a comparative study of Finnish-and Swedish-speaking schoolchildren in Finland. Scand. J. Publ. Health 28 (3), 179–187.

Tanaka, R., Nolan, R.P., 2018. Psychobehavioral profiles to assist tailoring of interventions for patients with hypertension: latent profile analysis. J. Med. Internet Res. 20 (5), e149. https://doi.org/10.2196/jmir.8757.

Tenfelde, S.M., Hatchett, L., Saban, K.L., 2018. "Maybe black girls do yoga": a focus group study with predominantly low-income African-American women. Compl. Ther. Med. 40, 230–235. https://doi.org/10.1016/j.ctim.2017.11.017.

Uckelstam, C.-J., Philips, B., Holmqvist, R., Falkenström, F., 2019. Prediction of treatment outcome in psychotherapy by patient initial symptom distress profiles. J. Counsel. Psychol. 66 (6), 736–746. https://doi.org/10.1037/cou0000345.

UCLA: Statistical Consulting Group. (n.d.). Statistical Computing Workshop: Using the SPSS Mixed Command. UCLA: Statistical Consulting Group. https://stats.idre.ucla.edu/spss/seminars/spss-mixed-command/.

Väestö | Tilastokeskus, 2018, December 31. Tilastokeskus. https://www.tilastokeskus.fi/tup/suoluk/suoluk_vaesto.html.

Volanen, S.-M., Suominen, S., Lahelma, E., Koskenvuo, M., Silventoinen, K., 2006. Sense of coherence and its determinants: A comparative study of the Finnish-speaking majority and the Swedish-speaking minority in Finland. Scandinavian J. Publ. Health 34(5), 515–525.

Zenner, C., Herrnleben-Kurz, S., Walach, H., 2014. Mindfulness-based interventions in schools—a systematic review and meta-analysis. Front. Psychol. 5 (603), 1–20. https://doi.org/10.3389/fpsyg.2014.00603.