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Exploring multicultural classroom dynamics: A network analysis

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ABSTRACT

Students' relationships with peers and teachers strongly influence their motivation to engage in learning activities. Ethnic minority students, however, are often victimized in schools, and their educational achievement lags behind that of their majority group counterparts. The aim of the present study was to explore teachers' multicultural approach within their classrooms as a possible factor of influence over students' peer relationships and motivation. We utilized the novel methodology of estimating psychological networks in order to map out the interactions between these constructs within multicultural classrooms. Results indicate that a multicultural approach is directly connected to student motivation for both ethnic majority and minority students. Social integration within peer groups, however, seems to be a possible mediator of this relationship for the ethnic minority students. Due to the hypothesis generating nature of the psychological network approach, a more thorough investigation of this generated mediation hypothesis is called for.

Students who have better relationships with peers and teachers (Klem & Connell, 2004), and feel greater sense of relatedness, belongingness, inclusion, and support are more likely to be motivated to engage in learning (Deci & Ryan, 1985; Furrer & Skinner, 2003; Wentzel, 2009). Research shows that stereotypical expectations and cultural differences may, however, hamper the quality of relationships, leaving some students more vulnerable to rejection and exclusion. More specifically, students with a minority background are more likely to face ethnic victimization in the form of name-calling, teasing, and social-exclusion from peer groups (Verkuyten, Kinket, & van der Wielen, 1997; Verkuyten & Thijs, 2002), which may largely explain their low levels of adjustment to the educational system, (Dimitrova, Chasiotis, & Van De Vijver, 2016) as not feeling socially well integrated within a peer group undermines motivation (Cerezo & Ato, 2010) and educational achievement (Walton & Cohen, 2007). Studies have shown that victimized students, compared to their more accepted classmates, are less engaged with school and academic goals (Totura, Karver, & Gesten, 2014) and receive lower grades (Buhs & Ladd, 2001; Lopez & Dubois, 2005). Indeed, in many European countries, ethnic minority students' educational achievement lags behind that of their majority counterparts (Schleicher, 2006). The current study uses the novel methodology of psychological networks to explore a multicultural approach to diversity as a possible factor of influence over students' motivation –a strong predictor of educational achievement (Lee, 2014).

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1. A multicultural approach to diversity in the classroom

Among their many roles, teachers act as role models, disciplinarians, and instructors (Furrer & Skinner, 2003). They create guidelines for children's social behavior (Ryan & Patrick, 2001), give explicit messages about their peer interactions, and ideally act as role models in how to engage in respectful communication (Jennings & Greenberg, 2009). Teachers, therefore, have the potential to influence student motivation with how they approach diversity, by promoting or undermining students' sense of relatedness (Furrer & Skinner, 2003) and belonging (Osterman, 2000) to social groups.

A multicultural approach to diversity has been designed to improve both students' intergroup relations and educational achievement by establishing anti-discriminatory norms, emphasizing the negative consequences for victims of ethnic discrimination, educating children about ethnic-cultural differences, and promoting recognition and acceptance of others (for a broad conceptualization see Banks, 2004).[1] Indeed, teachers have been found to influence students' attitudes based on the multiculturalism norms they express (Grütter & Meyer, 2014; Verkuyten & Thijs, 2013), and their constructive reactions to negative peer incidents have been found to counteract the undesired outcomes of mixed education, such as ethnic victimization (Verkuyten & Thijs, 2002). Both when experimentally manipulated and measured as an individual difference, multiculturalism was found to predict lower prejudice in majority group members (as reported in Plaut, Thomas, & Goren, 2009). Similarly, minority students have been found to perceive less discrimination in classrooms where teachers endorse multiculturalism (Brown & Chu, 2012).

Nevertheless, little is known about how teachers implement multicultural strategies and how it affects the students in European countries as the research in this field has been mainly focusing on the U.S. educational context (Agirdag, Merry, & Van Houtte, 2016; Verkuyten & Thijs, 2013). The questions that remains is "how and to what extent a multicultural approach influences student motivation in European classrooms?" Examining multiculturalism outside of the U.S. can, therefore, not only improve student outcomes in those countries but can also contribute to the theoretical advancement within the field of multicultural education by either validating or contradicting the existing frameworks (Agirdag et al., 2016). As such, the current study addresses the stated research question by modeling students' motivation and their perceptions of teachers' multicultural approach in relation to their classroom peer relationships (as possible means of teacher influence over student motivation).

1.1. Classrooms as complex systems

Grounded on an ecological framework, the current study views classrooms as complex social systems (Bronfenbrenner & Morris, 2006) in which all actors (students and teachers) in a classroom influence each other and the effect of one depends on the nature of the other (Burns & Knox, 2011). To map out multicultural classroom interactions, we aim to introduce a first application of state-of-the-art exploratory research methods in which psychological network models are used.

The use of network modeling for exploratory studies has been extensively applied to personality research (e.g., Costantini et al., 2015; Costantini et al., 2015; Costantini et al., 2017; Cramer et al., 2012), and has been insightful in various other fields of research such as health sciences, social relations, and more recently psychopathology and psychiatry (e.g., Dalege, Borsboom, van Harreveld, Waldorp, & van der Maas, 2017; Deserno, Borsboom, Begeer, & Geurts, 2016; Isvoranu et al., 2016; Kossakowski & Cramer, 2018; McNally, 2016; van Borkulo et al., 2015). Distinct from social networks (Wasserman & Faust, 1994), psychological networks (Borsboom & Cramer, 2013; Epskamp, Borsboom, & Fried, 2018) are abstract models comprised of a set of nodes that represent variables (e.g., attitudes, symptoms, test items), a set of edges that represent unknown statistical relationships between nodes, and information with regard to the nature of the nodes and edges (e.g., strength of the relationships). The estimation of edges separates psychological networks from social networks in which the links between the nodes are already known (Costantini, Epskamp, et al., 2015; Epskamp & Fried, 2016). For instance, nodes in a social network could represent students and the edges can represent observed friendships. In a psychological network, on the other hand, nodes represent variables that differ across people, such as perceived discrimination or motivation. The edges in such networks are unique associations that need to be estimated. These models show conditional association between two variables after controlling for all other variables in the network, and therefore differ from, for example, factor analysis models and interpreting marginal correlations by highlighting the unique variance between two pairs of variables, rather than the common variables over all variables. Such associations arise if there are causal associations between the variables; and, when no unobserved common causes are assumed, these associations are often not present if there are no causal relations (Koller & Friedman, 2009; Lauritzen, 1996).

1.1.1. Relationships between network models and structural equation modeling

The hypothesis generating and exploratory nature of the network approach extends the benefits of hypothesis testing statistical techniques widely used in the social sciences. For a better understanding of the network approach's contributions, we compare it to Structural Equation Modeling (SEM) as it is a common methodology that can be used with the type of data used in the current study (e.g., Le & Johansen, 2011). The arguments below summarize more detailed discussions on this topic published elsewhere (Epskamp,

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[1] The term multicultural education has been coined to describe various approaches and practices pertaining to multiculturalism in a school context (Banks, 1993, 1989; Delpit, 1996; Gay, 1988, 2000; Ladson-Billings, 1995; Nieto, 1996). To effectively implement multicultural education in schools, however, its conceptualization must be comprehensive, and its dimensions must be clearly outlined (Banks & Banks, 1995). Therefore, for this study, we utilize Banks's widely used conceptualization (Banks, 2004) as it covers more ground in his definition than other conceptualizations (Zirkel, 2008).

Rhemtulla, & Borsboom, 2017; Epskamp, Waldorp, Mõttus, & Borsboom, 2016).

(1) SEM allows for confirmatory testing of causal models, through the use of directed network models, typically assumed to be acyclic (a variable does not cause itself directly or indirectly). Exploratory estimation of causal models, however, is far from trivial, mainly because there might be a great number of equivalent fitting models that are all differently parameterized and the possibility of including more edge parameters than there are observed pieces of information (variances and covariances). Both equivalent models and having potentially more parameters than observed pieces of information may lead to under-identification. Undirected networks, on the other hand, are uniquely identified and not potentially over-parameterized. These properties allow for efficient exploratory model selection search algorithms, such as the regularization techniques used in this paper, that accurately retrieve the network structure with increasing sample size (Foygel & Drton, 2010).

(2) There is a close connection between undirected network models (such as partial correlation networks) and causal models (such as used in SEM). When items are assumed not to covary due to the presence of unobserved common causes, we can expect a non-zero partial correlation between variables *A* and *B* only if *A* causes *B*, *B* causes *A*, there is a reciprocal relationship between them, or both *A* and *B* cause a third variable in the network. As such, the presence of an edge in the undirected network may be indicative of a potential causal path, as we would expect such an edge to occur if there is a causal path in the true generating model. To this end, undirected network models can be interpreted as exploratory hypothesis-generating models that highlight potential causal pathways.

(3) Compared to a second way in which SEM is often used–the modeling of latent common causes, while highlighting relations between variables–the network approach, takes dependencies into account and controls for every other variable in the network; therefore, it focuses on unique variance between variables rather than shared variance across variables (Costantini, Epskamp, et al., 2015). The shared variance, however, is still retained in the network; thus, the influence of latent common causes emerges in the network as clusters of interconnected nodes. To this end, clusters in a network may be indicative of latent variables, and one my investigate the dimensionality of a dataset by investigating the clustering of the network (Golino & Epskamp, 2017).

(4) Finally, undirected network models are closely related to multiple regression models. The nodes that are connected to a node of interest are also likely to be significant predictors of the node in a multiple regression model. We would thus not expect an edge in the network if an independent variable does not predict the dependent variable. Different from multiple regression, the network also shows which variables would predict the independent variables; thus, mapping out linear prediction and multicollinearity among all the variables (Epskamp & Fried, 2016). To this end, network models may reveal patterns in the data (e.g., mediation) that might otherwise go unnoticed unless we specifically hypothesize and test every possible model with the relevant variables.

1.1.1.1. The present study. Despite the growing interest in psychological network analysis, this type of analysis has not yet been introduced to the educational literature. Considering its aforementioned benefits, we expect that its application could substantially contribute to our knowledge about interpersonal processes in educational contexts because of its unique approach to classrooms as complex systems. Especially since there is only limited information on multiculturalism in European schools and classrooms, an exploratory and hypothesis generating, detailed (i.e., on an item level), and computationally effective investigation (i.e., simultaneous visualization) of classroom interactions is warranted.

The current study therefore introduces a first application of psychological network models in order to 1) explore relationships between students' perceptions of various classroom experiences to inspect plausible mechanisms with which teachers' perceived multicultural approach influences student motivation, and 2) compare students with an ethnic majority and minority cultural background in order to understand commonalities and idiosyncrasies in classroom experiences. With the current study, we expand the multicultural education literature by examining teachers' multicultural approach in relation to student motivation outside of the U.S.; the motivation literature by building on the only few studies investigating the joint influence of teachers and peers on student outcomes (for an overview, see Vollet, Kindermann, & Skinner, 2017), none of which have investigated motivation in relation to multiculturalism; and, the educational literature in general, by introducing the application of the novel psychological network approach to classroom complex social systems.

Complementary to the previous analyses performed on these data[2] (see Verkuyten & Thijs, 2002), simultaneous visualization of the relationships between items allows us to explore direct and indirect connections between the variables, experiences students find the most important, possible pathways of teacher influence on student motivation, and differences between majority and minority group students. Based on the literature that is briefly reviewed above, we included constructs in our model that are expected to interact with student motivation. We are specifically interested in intrinsic motivation of students that is manifested as interest and enjoyment in learning, which drive task engagement (Deci & Ryan, 1985; Skinner, Furrer, Marchand, & Kindermann, 2008).

As sketched earlier, quality of social interactions influences student motivation. In order to tap on both the positive and negative aspects of these interactions, our models contain social integration and victimization constructs. Social integration refers to the relations among actors, and when discussing ethnic processes, between members of ethnic majority and minority groups (Stark, 2011). In our text, we use social integration as an umbrella term that reflects the degree of relatedness, belongingness, and acceptance to a peer group (Beresnevièiûtë, 2003). Furthermore, we included victimization that can both be general (i.e., non-ethnic victimization) or specifically due to one's ethnic background (i.e., ethnic victimization) in the form of social exclusion and/or name-calling. Ethnic victimization is an attack and/or negative response about one's ethnic background, and it may be directed to an individual (i.e., individual ethnic victimization) or a group as a whole (i.e., ethnic peer group victimization; Maes, Stevens, & Verkuyten, 2013),

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[2] Previous analyses on the data did not include all the variables we have included in our analyses (e.g., motivation, integration). Therefore, a direct comparison between the previous findings and ours was not possible.

Table 1
Demographic characteristics of the largest ethnic groups.

Variable	Dutch (N = 1641)	Turkish (N = 612)	Moroccan (N = 463)	Surinamese (N = 135)
Sex				
Male	49%	49%	52%	58%
Female	51%	51%	48%	42%
Age (years)	11.27 (0.80)	11.53 (0.83)	11.51 (0.81)	11.42 (0.79)
Male	11.28 (0.81)	11.48 (0.83)	11.56 (0.81)	11.44 (0.79)
Female	11.25 (0.79)	11.58 (0.84)	11.46 (0.80)	11.39 (0.80)

Note. The reported sex refers to the percentages, while the reported age in years refers to the mean age (SD).

which are both included in our network models. Throughout the text, social integration and victimization are together referred to as 'peer relationships'. As the degree to which children identify with their ethnic group may either act as a buffer against the negative effects of perceived ethnic victimization by providing social support (Mossakowski, 2003) or may sensitize one by signaling that one's group identity is depreciated by others (McCoy & Major, 2003), we have not only included students' ethnic background in our model but also the extent to which students identified with it.

Teachers are instructors and role models, and they can shape the classroom climate with how they deal with diversity. Effectiveness of a multicultural approach in reducing victimization and promoting positive relationships, therefore, depends not only on instruction but also on the perceptions of how teachers themselves deal with ethnic diversity and negative interactions (Banks, 1995; Bigler, 1999; Verkuyten & Thijs, 2002). Hence, in our models, we included level of multicultural education and teachers' reactions to ethnic victimization, as perceived by the students. The former entails whether teachers explicitly discuss issues related to ethnic diversity in order to foster understanding and appreciation of multiculturalism, fight any negative interethnic interactions, and promote positive ones. The latter entails whether teachers interfere with acts of victimization, and whether children can approach their teacher to report on such acts (Verkuyten & Thijs, 2002). Throughout the text, they are together referred as 'teachers' multicultural approach'.

We expect differences between the two groups of students' networks as majority and minority group children's classroom experiences differ from each other (e.g., ethnic victimization rates). In the following, we outline the application of psychological network analysis as it is new to the educational literature (for an application of Ising network modeling to educational data for methodological research see Marsman, Maris, Bechger, & Glas, 2015); however, a more thorough overview of the statistical details can be found in previous publications that are focused strictly on this methodology (e.g., Costantini, Epskamp, et al., 2015; Epskamp et al., 2018).

2. Method

2.1. Data and participants

We reanalyzed the data from Verkuyten and Thijs (2002) who originally investigated the extent of ethnic victimization among different ethnic groups of students. In total, 3806 children aged 10–13 from 182 primary school classes answered the questionnaire. A small proportion of the data was missing (1.6%). The analyses investigating the cause of missingness (e.g., missing at random, missing completely at random) assume that the data are normally distributed. However, due to the ordinal nature of the data, we could not check this missingness assumption (Jia, 2016). Therefore, we handled missing data with pairwise deletions as it is the default method of handling missing data for network analysis.

As displayed in Table 1, the mean age of the Dutch sample (N = 1641) was 11.27 years with 49% male, which formed what we operationalized as the "majority group" sample. The Turkish-Dutch sample (N = 612) had a mean age of 11.53 years with 49% male, and the Moroccan-Dutch sample (N = 463) had a mean age of 11.51 years with 52% male. These two ethnic groups formed what we operationalized as the "minority group" sample (N = 1175).[3]

2.2. Measures

The internal consistency of the scales used, as quantified by Cronbach's alpha, was relatively poor, ranging from 0.56 to 0.69. Cronbach's alpha was designed to investigate the sum score of scales, and is high when each item in a scale correlates highly with all other items in the same scale. A high Cronbach's alpha thus indicates that individual items of the scale are redundant, as they are very similar. Because the network analysis focuses on the unique role of each item rather than the sum scores, it would not be desirable for the scales to feature high Cronbach's alpha. In fact, lower internal consistency indicates that responses should be studied at the item level rather than the sum-score level, as is done in the current study (Diamantopoulos, Riefler, & Roth, 2008).

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[3] The permutation test results, after 5000 iterations, indicate that Turkish and Moroccan sample networks do not significantly differ from each other, with a p value of 0.87 and 0.77 for the difference in overall connectivity and structure respectively. For a visualization of the two networks, see Supplementary materials Fig. S1.

Table 2
Items of the student measures and their assigned colors and labels.

Measure	Item label	Domain color (in pastel)	Item description
Perceived multicultural education	ME1		Teacher talking about different cultures
	ME2	Green	Teacher talking about different customs
	ME3		Teacher talking about being good to ethnic others
	ME4		Teacher talking about fairness to ethnic others
Perceived teacher reactions to victimization	TR1		Teacher reacting to discrimination
	TR2		Children reacting to discrimination
	TR3	Sea green	Reporting an incident of discrimination to the teacher
	TR4		Other children reporting an incident of discrimination to the teacher
Motivation	M1		Liking to learn
	M2	Red	Eagerness for assignments
	M3		Eagerness for new information
	M4		Desire to know a lot
Non-ethnic victimization	NEV1		Non-ethnic name-calling in school
	NEV2	Orange	Non-ethnic social exclusion in school
Individual ethnic victimization	IEV1		Ethnic name-calling in school
	IEV2	Purple	Ethnic social exclusion in school
Ethnic peer group victimization	EPGV1		Ethnic peer group name-calling in school
	EPGV2	Pink	Ethnic peer group exclusion in school
Social integration	I1	Yellow	Getting along with other children
	I2		Liking to play with other children
	I3		Other children disliking you (R)
	I4		Difficulty making friends (R)
Ethnic identity	EI1	Blue	Liking being part of the ethnic group
	EI2		Important to be part of the ethnic group
Class composition	CC	Dark red	Minority group concentration within the classrooms

Note. The variable 'class composition' is only present in the *Between Class Effects Network* and represents the percentage of minority group children with a Turkish and Moroccan background.

We included in the analyses items of the scales measuring children's motivation, general and ethnic victimization at an individual and peer ethnic group level, ethnic background, ethnic identity, social integration, and their perceptions of their teachers' multicultural approach (level of multicultural education and teacher reactions to ethnic victimization). Items belonging to students' perceptions of multicultural education and perceptions of teacher reactions to ethnic victimization are referred to as 'teacher factors' from here onwards (see Table 2 for item descriptions).

2.2.1. Perceived level of multicultural education

Perceptions of multicultural education were obtained using four questions on a five-point scale (1 = 'no, never' to 5 = 'yes, very often'). Example items are "Does the teacher sometimes talk about different cultures?" and "Does the teacher sometimes talk about being fair to children from different countries?" This scale has been previously used in various Dutch studies (e.g., Kinket & Verkuyten, 1997, 1999), and showed an adequate Cronbach's alpha of 0.69 in the current study.

2.2.2. Perceived teacher reactions to ethnic victimization

Students were asked to imagine that a child is being called names and teased by others because he or she is from another country. Subsequently, with four questions on a five-point scale (1 = 'no, never' to 5 = 'yes, very often'), they were asked whether their teacher would say and do something about the incident and whether they and their classmates could approach their teacher about it. This scale has been successfully used in previous Dutch studies (e.g., Kinket & Verkuyten, 1997), and showed an adequate Cronbach's alpha of 0.62 in the current study.

2.2.3. Motivation

Children's learning motivation has been assessed using four questions on a five-point scale (1 = 'not at all' to 5 = 'very much') asking the children, for instance, to indicate the extent to which they like learning new things and desire to know a lot. The items reflect various aspects of intrinsic motivation to gain mastery of educational material, such as enthusiasm, interest, and enjoyment that are the foundations of high-quality learning (Ryan, Connell, & Grolnick, 1992; Skinner et al., 2008), and have Cronbach's alpha of 0.58.

2.2.4. Non-ethnic victimization

Perceived personal victimization was assessed with two questions on a five-point scale (1 = 'no, never' to 5 = 'yes, very often'). The children were asked to indicate the frequency to which they were called names and teased, and socially excluded from play in school. These experiences represent important aspects of peer victimization, and have been widely investigated in previous research using the current items (Agirdag, Demanet, Van Houtte, & Van Avermaet, 2011; Thijs, Verkuyten, & Grundel, 2014; Verkuyten & Thijs, 2006). The reliability analysis indicated a Cronbach's alpha of 0.60.

2.2.5. Individual ethnic victimization

Following previous research (e.g., Verkuyten & Thijs, 2006), perceived personal ethnic victimization in school was assessed with two questions on a five-point scale (1 = 'no, never' to 5 = 'yes, very often'). The children were asked to indicate the frequency to which they were called names and teased, and socially excluded from play due to their ethnic background (Cronbach's alpha = 0.68).

2.2.6. Ethnic peer group victimization

The same two questions that were used to assess individual ethnic victimization were asked in relation to children's peer ethnic group (Cronbach's alpha = 0.68).

2.2.7. Social Integration

Children answered four questions on a four-point scale (1 = 'no at all' to 4 = 'very much'), which assessed various aspects of social integration reflecting the relations among actors, stability of social relations, and how one perceives himself/herself in a social situation (Beresnevièiûtë, 2003). The items showed adequate consistency, with a Cronbach's alpha of 0.58.

2.2.8. Ethnic background

Children indicated their ethnic background self-definitions on an open question and on two questions concerning the background of their parents. Children's ethnic background was identified based on whether they used the same label to define themselves as well as their mother and father.

2.2.9. Ethnic identification

Children's ethnic identification was assessed with two questions on a four-point scale (1 = 'no at all' to 4 = 'very much') indicating how happy they feel belonging to their ethnic group, and how important it is for them to belong to their ethnic group. The items were successfully used in previous research (e.g., Maes et al., 2013), and showed Cronbach's alpha of 0.56 in the current study.

2.2.10. Class composition

For each classroom, we calculated the combined proportion of students who identified themselves and their parents as Turkish and Moroccan.

2.3. Procedure - network construction and visualization

The network construction, visualization, and analysis were performed using the open-source 'R' statistical software (R Development Core Team, 2016) and the R-packages 'bootnet' (Epskamp et al., 2018) and 'qgraph' in particular (Epskamp, Cramer, Waldorp, Schmittmann, & Borsboom, 2012). The R script is available in the Supplementary materials. The networks represent Gaussian graphical models (Lauritzen, 1996); every item from each measure is represented as a 'node', and the partial correlation between any two items after controlling for all other items is represented as an 'edge'. Green and red edges symbolize positive and negative partial correlations respectively; the wider and more saturated the edges, the stronger the partial correlations are. The thickest possible links correspond to the maximum value of the strongest edge in the network (this is displayed below the networks as *maximum*) and the closer the edge weights get to 0 the less saturated and smaller the edge is. For controlling spurious connections, which occur when two variables have no actual relationship but are statistically linked, we used a regularization method that resulted in a sparser and more interpretable network. Specifically, we utilized the 'graphical LASSO' algorithm as implemented in the 'glasso' package for R (Friedman, Hastie, & Tibshirani, 2008, 2015). The glasso algorithm uses a tuning parameter controlling the network sparsity, which we selected by minimizing the extended Bayesian information criterion (EBIC; Chen & Chen, 2008; as described in Foygel & Drton, 2010). There is no threshold necessary for the edges to be displayed; all edges that survive regularization are displayed within the networks. This regularization ensures that only the statistically meaningful edges are retained in the network and controls for Type 1 errors that may result from sampling error. We used the automated procedure implemented in the 'qgraph' package, following the steps from Epskamp and Fried (2016). The glasso algorithm requires a covariance matrix as input for which we used polychoric correlations to account for the ordinal nature of the data (Epskamp & Fried, 2016).[4] The correlation matrices and the resulting weight matrices after the glasso regularization are provided in the Supplementary materials Table S3.

2.4. Analytical approach

2.4.1. Network analysis and comparison

We focused our analyses on the largest ethnic minority groups, the three of which were of specific interest to us. People of Turkish and Moroccan origin form the largest ethnic minority groups in the Netherlands and also are the most victimized (CBS, 2016; Verkuyten & Thijs, 2002). Thus, we focused on these two groups as ethnic minority groups and compared them to the Dutch majority group. For more comparable networks in terms of sample size, we combined the Turkish and Moroccan minority groups under one sample. The constructed networks are analyzed and compared in terms of their overall structure, importance of each node

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[4] One exception is when we constructed the between class effects network, which is further detailed below. This network is based on regular Pearson correlations.

(centrality), and shortest pathways between teacher factors (teacher reactions to ethnic victimization and level of multicultural education) and student motivation. For each network in our study, we performed accuracy tests to check how subjective the results are to sampling variation (Epskamp, Borsboom et al., 2016; see Supplementary materials Figs. S2–7).

The networks are compared using a permutation-based test that is integrated in the R-package 'NetworkComparisonTest' (van Borkulo et al., 2015). The test compares two networks in terms of (1) their network structures as a whole, in other words, whether they are identical, (2) their overall connectivity level, simply put, whether they are connected at the same density – average strength of all edge weights, and (3) the difference in strength of individual edge weights (i.e., connections; for a more detailed methodological description, see van Borkulo, Boschloo, Schoevers, Borsboom, & Waldorp, 2016). In addition, note that Supplementary materials Figs. S6–7 (plots on the left) inform us of all the edges that are significantly different from each other ($\alpha < 0.05$). In our networks, much more than half of the edges within the networks can be interpreted as significantly different from one another and we can therefore safely say that one edge is stronger than another edge when interpreting each network.

Each node's importance within the networks can be investigated by looking at the centrality measures, the most commonly used being node 'strength', 'closeness', and 'betweenness' (Costantini, Epskamp, et al., 2015; Newman, 2010; Opsahl, Agneessens, & Skvoretz, 2010). Traveling from these nodes to other nodes is fairly easy because they are very well connected within their networks. Therefore, they could be understood as having high predictive value for other nodes (Costantini, Epskamp, et al., 2015). In undirected weighted networks, as the ones computed here, we compute the node 'strength' by examining how many connections are attached to each node and how strong these connections are. 'Closeness' quantifies how far removed a node is from all other nodes, and 'betweenness' measures how often a node is situated within the shortest path between two other nodes (Opsahl et al., 2010). The centrality plots are visualized using the R-package 'ggplot2' (Wickham, 2016).

Finally, we constructed networks that illustrate the shortest pathways between teacher factors and student motivation in the majority and minority groups, which allows for clear identification of possible pathways of influence from one node to another and mediating nodes in between (Brandes, 2008; Isvoranu et al., 2016). In other words, these pathways highlight the most efficient ways that a node connects to another node. Hence, our shortest pathways answer the question "what is the most efficient route to take in order to reach student motivation from teachers' multicultural approach (i.e., teachers' reaction to victimization and level of multicultural education items)?" The shortest pathways between any two nodes depend on the distance needed to go from one to the other as well as their connection's strength, which is computed using Dijkstra's algorithm (Dijkstra, 1959).

2.4.2. An exploration of between class effects

As it is not (yet) possible to estimate student and class-level variables in one network, variables that might moderate the strength of estimated relations such as 'ethnic minority percentage in class' were not included in the comparative network analyses. Previous analysis of the same data shows, for instance, that Dutch children were less, and Turkish and Moroccan children were more likely to report ethnic victimization when there is a higher Dutch children proportion in their classrooms (Verkuyten & Thijs, 2002). To overcome this limitation, we estimated a second network structure on class-level variables. In this analysis, student-level variables were averaged per class. Thus, in this class-level network, nodes represent either averages of student-level variables for each class or class-level variables. Because at the class-level ethnicity is no longer categorical (every class has a different ethnic composition), we could not split the class-level data on ethnicity as was done in the student-level analysis. Instead, we added the class-level variable 'class composition' as a node to our analysis, which represents the composite percentage of students with Turkish and Moroccan backgrounds (i.e., our ethnic minority group).

3. Results

3.1. Network analysis and comparison

Each node in our networks indicates a single item. Items are color-coded to indicate which scale they belong to (see Table 2 for item descriptions).

We compared the similarities in the basic structure of the two samples, how densely their networks are connected (connectivity), and the individual connections of the two groups' networks (van Borkulo et al., 2015). The results indicate same level of connectivity for majority and minority student networks ($p = .09$), but significant differences in terms of the network structures ($p = .006$).[5] In other words, nodes are connected at a similar density in both groups, however the networks are not identical due to the presence or difference in strength of certain connections. The network structures (Fig. 1) of both groups illustrate that the nodes that are specifically strongly connected (and that do not belong to the same measure) seem to be similar in both networks; the differences in connections between (a) teachers' multicultural approach and motivation, (b) teachers' multicultural approach and peer relationships, and (c) peer relationships and motivation are discussed below.

Teachers' multicultural approach (i.e., teacher reactions to victimization and level of multicultural education) is directly and indirectly connected to all student variables. To start with, items from teacher reactions to victimization have many direct and indirect connections with the motivation items. Especially being able to report an incident of discrimination to the teacher (*TR3*) seem to be very well connected to almost all motivation items in both groups (*TR3 – M1, TR3 – M2, TR3 – M3* in the majority group; and *TR3 – M1, TR3 – M2, TR3 – M3, TR3 – M4* in the minority group). However, a more salient teacher reactions item is the extent to

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[5] This is a result after 5000 iterations.
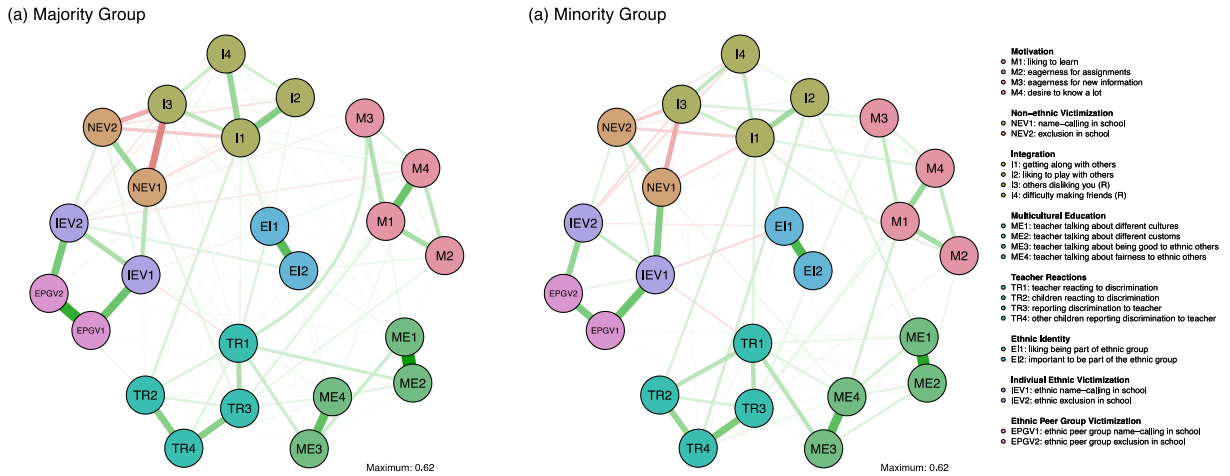
Fig. 1. Networks depicting the item partial correlations for the (a) majority and (b) minority ethnic groups respectively. Item groups are differentiated by colors. Thicker and darker edges represent stronger connections (green and red edges represent positive and negative connections respectively). (For interpretation of the references to color in this figure legend, the reader is referred to the web version of this article.)

which teachers react to acts of discrimination (*TR1*), which has a strong direct connection with eagerness for new information in the majority group (*TR1 – M3*) and a strong connection with getting along with others in the minority group (*TR1 – I1*). To continue, items from level of multicultural education similarly have direct and indirect connections with the motivation items in both groups; however, there are more direct and salient connections in the minority group network. The connections that stand out within the minority network are the ones between teacher talking about different customs and eagerness for assignments, and teacher talking about fairness to ethnic others and liking to learn (*ME2 – M2, ME4 – M1* respectively).

In addition, we see direct connections between teachers' multicultural approach and peer relationships (e.g., *TR2 – I2, TR1 – I1, TR1 – IEV2, ME1 – I2*). In both groups, the teachers' multicultural approach has positive and direct connections with the integration items. Further, the connections we observe between teacher reactions and victimization items are negative, whereas the ones between multicultural education and victimization are positive (e.g., *ME4 – IEV2* in the majority, *ME4 – NEV1* in the minority group).

The direct connections between peer relationships and motivation items are salient in both networks. We observe positive connections between getting along with and liking to play with other children, and desire to know a lot (*I – M4; I2 – M4* respectively) in the majority network; and, positive connection between getting along with other children and desire to know a lot (*I1 – M4*), and negative connection between difficulty making friends and desire to know a lot (*I4 – M4*) in the minority network. Moreover, we observe negative direct edges between ethnic victimization by name-calling at the individual level, and eagerness for new information and desire to know a lot (*IEV2 – M3, IEV2 – M4* respectively) in the majority group; and between ethnic victimization by name calling at the individual level and eagerness for new information (*IEV2 – M3*) in the minority group. It is notable that in the minority group network, integration items are more connected with the motivation items compared to the victimization items; whereas, connectivity is similar for integration and motivation, and victimization and motivation items in the majority group network.

3.2. Centrality analysis

The centrality measure 'strength' shows a similar pattern of results in both groups, which is expected given the same level of connectivity across the two networks. The other centrality indices indicate that teacher reacting to discrimination (*TR1*) and reporting discrimination to teacher (*TR3*) for the majority group, and getting along with the other children (*I1*) and ethnic victimization by name-calling at the individual level (*IEV1*) for the minority group (Fig. 2) show the highest centrality in their represented order. This suggests that these are important nodes in their corresponding networks, because they are very well connected to the other nodes. Therefore, they have the potential to have the largest influence on other nodes in their networks. The centrality indices are regarded as interpretable based on the accuracy and stability analyses (see Supplementary material Figs. S4 and 5).

3.3. The shortest paths analysis

In order to map out the most efficient pathways of influence, the shortest paths between teachers' multicultural approach and student motivation were investigated for the two groups. Mapping these pathways can help teachers determine the specific multicultural strategies that can be the most effective in motivating students with different experiences and needs. Fig. 3a illustrates the shortest pathways in the majority group. To reach most of the motivation items from multicultural education, connections go through teacher reacting to discrimination (*TR1*); and from teacher reactions, they go through teacher reacting to discrimination (*TR1*) or reporting on discrimination to teacher (*TR3*). Fig. 3b illustrates the shortest pathways in the minority group. The shortest route to
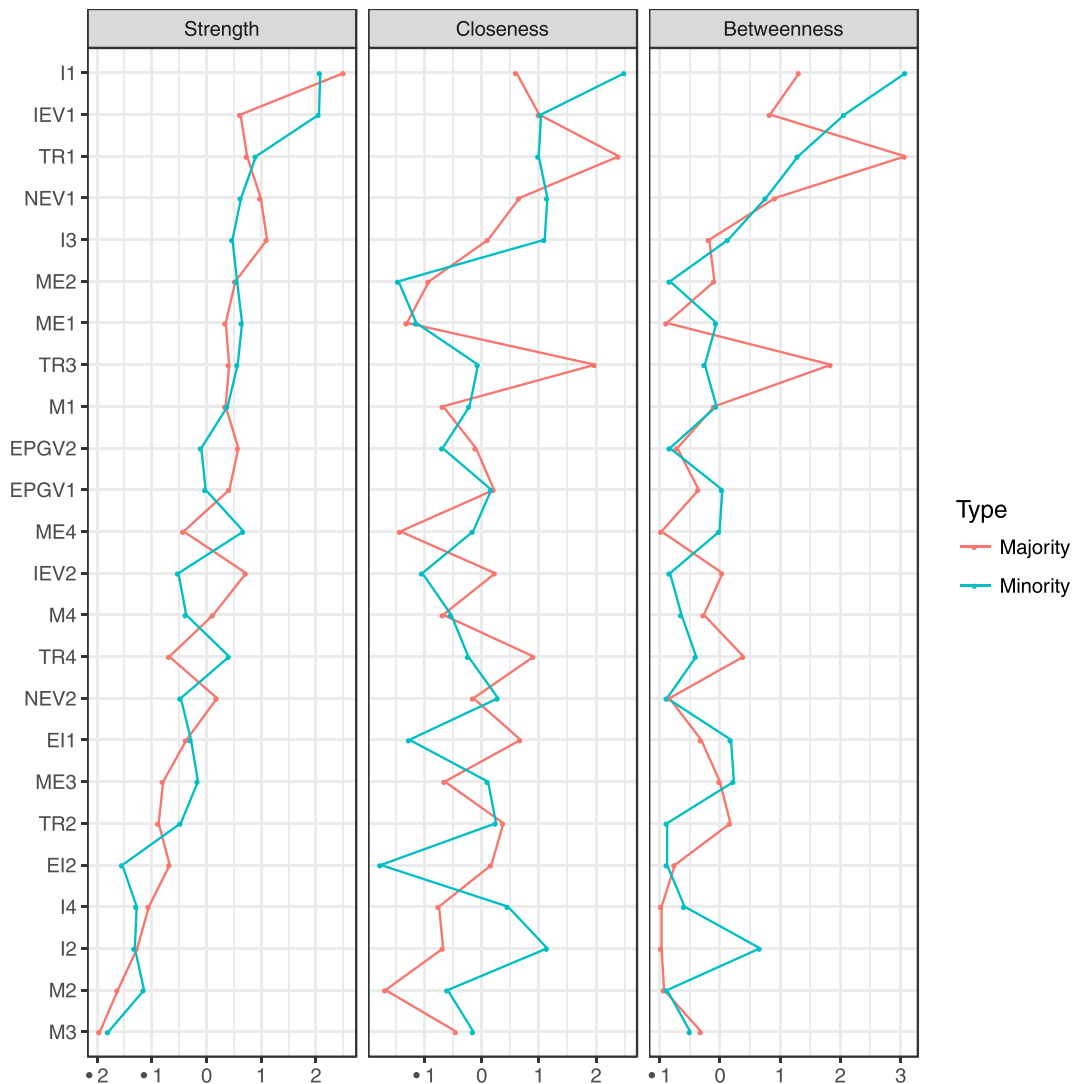
Fig. 2. Centrality plot for the majority (*in orange*) and minority (*in blue*) group networks. Centrality measures are shown as standardized z-scores. For the raw centrality indices, please see Supplementary Tables S1 and S2. (For interpretation of the references to color in this figure legend, the reader is referred to the web version of this article.)

reach most of the motivation items from multicultural education is via teacher talking about different customs (*ME2*) and teacher talking about fairness to ethnic others (*ME4*); the route to reach the motivation items from teacher reactions is via reporting on discrimination to teacher (*TR3*) but also via the integration item getting along with others (*I1*) that connects to eagerness for assignments (*M2*) and *M4* ('desire to know a lot').

We can clearly see that the shortest pathway between teachers' multicultural approach and motivation items is not mediated by items from another measure in the majority group network; whereas, in the minority group network, it seems to be mediated by the integration item getting along with other children (*I1*). More specifically, teacher reacting to discrimination (*TR1*) directly connects to motivation in the majority group. In the minority group, it directly connects to whether children themselves react if they are discriminated against (*TR2*), which in return connects to motivation items via the integration item getting along with other children (*I1*).

Moreover, in the majority group, multicultural education connects to motivation only via the teacher reactions item teacher reacting to discrimination (*TR1*). In the minority group, we observe direct connections between multicultural education and motivation items, and more direct connections from teacher reactions item reporting an incident of discrimination to the teacher (*TR3*) to various motivation items, highlighting the importance of cultural sensitivity and teachers' perceived approachability for the minority group students.

The centrality measure betweenness was regarded as interpretable based on the accuracy and stability analyses for both the ethnic majority and the ethnic minority group networks (see Supplementary material Figs. S4 and 5). As described above, this measure is
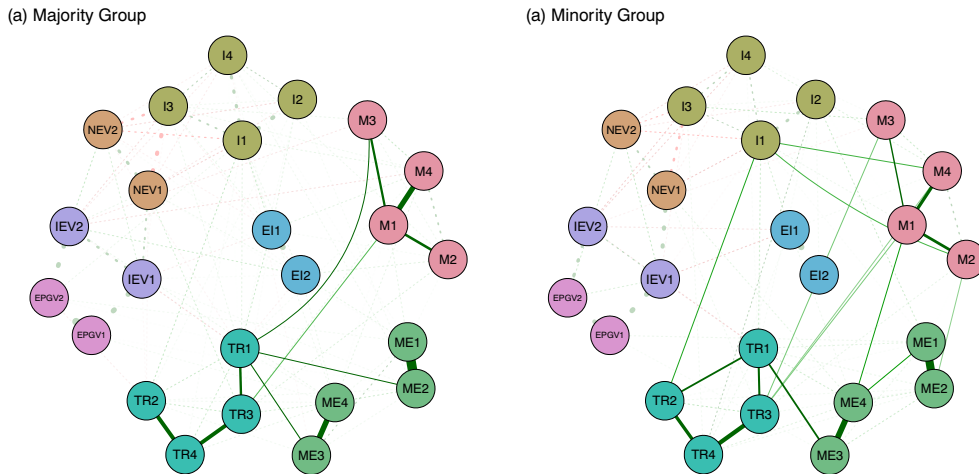
Fig. 3. Shortest pathways from teacher factors to 'motivation' *a)* for majority and *b)* for minority samples. The edges belonging to the shortest paths are represented in solid lines, while the background edges are dashed. (For interpretation of the references to color in this figure legend, the reader is referred to the web version of this article.)

mostly informative on the mediating role of items, as well as shortest paths. Of note, however, the stability of shortest paths cannot be tested directly.

3.4. Between class effects network

We constructed a between-class effects network (Fig. 4) as we were interested in the influence of the class-level variable 'classroom composition'. Therefore, we only examined the direct connections between 'classroom composition' and other nodes. There are rather weak direct connections between classroom composition and teacher talking about fairness to ethnic others (*ME4*), ethnic victimization by exclusion at the individual level (*IEV2*), and at the peer group level (*EPGV1*), and by name-calling at the peer
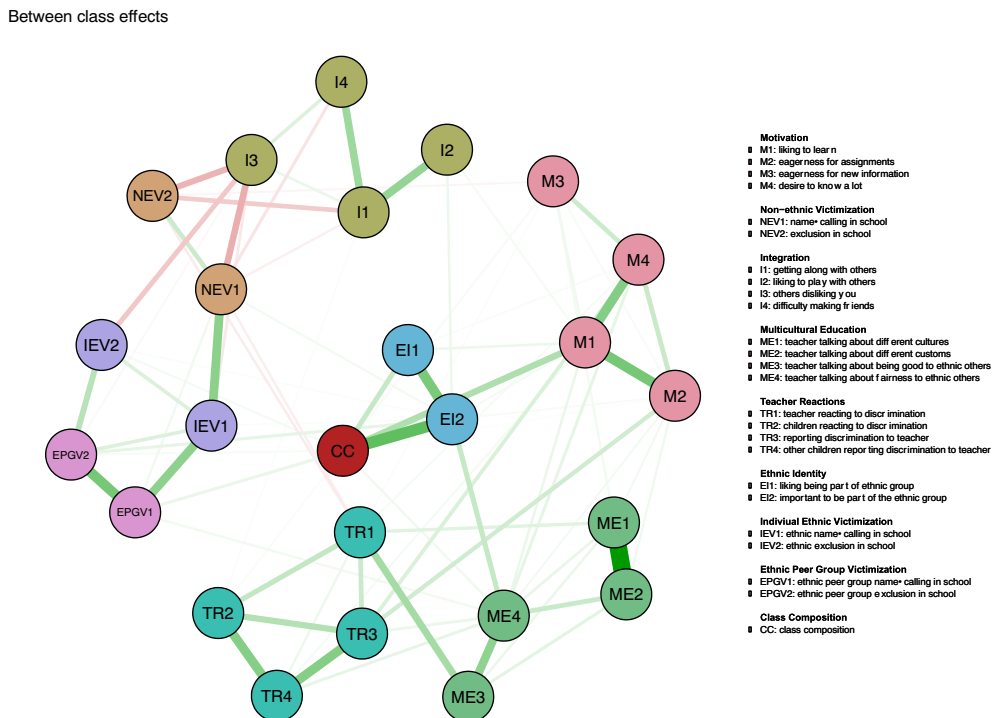
Fig. 4. Network depicting between class effects, including both class (i.e., class composition) and student level variables. (For interpretation of the references to color in this figure legend, the reader is referred to the web version of this article.)

group-level (*EPGV2*); and stronger connections with liking to learn (*M1*), liking being part of the ethnic group (*EI1*), and important to be part of the ethnic group (*EI2*).

4. Discussion

The current study provides a first application of the network approach to educational research, with the aim of mapping out multicultural classroom dynamics in primary school classrooms. Our findings highlight the importance of a multicultural approach for both ethnic majority and minority students' motivation. The main differences between the two student-group networks were the more direct connections peer relationships had in the minority group network with teachers' multicultural approach and motivation. We discuss our findings in the following by comparing the connectivity within the two student group networks in terms of the relations between (a) teachers' multicultural approach and motivation, (b) teachers' multicultural approach and peer relationships, and (c) peer relationships and motivation; the centrality indices; shortest pathways; and lastly by tapping on the between class effects network results.

4.1. Network analysis and comparison

Our comparative approach indicates that the mechanism through which teachers' multicultural approach influences student motivation might depend on different aspects of teacher factors for different ethnic groups. Both majority and minority group children seem to appreciate a tolerant atmosphere and approachability in their peers and teachers. We see, however, a stronger cultural aspect to this appreciation in minority group children. To explicate, while teachers' approachability and the extent to which they react to acts of discrimination have positive connections with both majority and minority group children's motivation perhaps due to its general content on victimization (e.g., promoting tolerance), teachers' level of multicultural education seems to have stronger direct connections to minority children's motivation due to its apparent relation with culture. The more frequently teachers engage in multicultural education, the more motivated children are, especially children with an ethnic minority background.

Teachers' multicultural approach is also directly connected to peer relationships for both ethnic groups of children. The more teachers react to discrimination (*TR1*), the less children report experiencing victimization (*IEV1*). However, children seem to report more experiences of victimization when their teacher talks more about fairness to ethnic others (*ME4*), which is especially the case for the ethnic minority group children. This signals that teacher reactions to victimization might have a positive effect on the frequency of ethnic name-calling and exclusion, and multicultural education might increase awareness, and knowledge on fairness and negative forms of behavior, as initially suggested by the results of previous analyses on the data (Verkuyten & Thijs, 2002). Alternatively, teachers might talk more about fairness to ethnic others due to the high reported ethnic victimization rates.

In addition, these peer relationships are very well connected with motivation in both of the networks. For both groups, victimization had a negative and integration had a positive relationship with motivation, while it is notable that integration items are better connected with motivation items compared to victimization items within the minority group network. This finding highlights the psychological need to relate to others and its importance for motivation (see e.g., Self-Determination Theory; Deci & Ryan, 1985).

4.2. Centrality analysis

The results of the centrality analyses were in line with the findings detailed above, such that teachers' possible influence within the networks was very salient. If they are targeted, central nodes can have a high impact on their corresponding networks as they are very well connected to the rest of the variables. Our centrality analyses showed that teachers' approachability when someone is discriminated against (*TR3*), and his/her constructive reaction (*TR1*) have the potential to have a high impact on the majority group network and reinforce positive outcomes. In the minority group network, getting along with others (*I1*) and ethnic victimization by name-calling (*IEV1*) seem to be fulfilling this important function, which are still directly and strongly connected to the central nodes of the majority group network.

4.3. The shortest paths analysis

In addition, by computing shortest pathway networks, we displayed how to possibly most efficiently reach student motivation from teachers' multicultural approach. Due to the strength of connections and the distance one needs to travel from one node to the other, certain pathways were estimated to be the most efficient routes that an effect would spread in the corresponding networks. In the majority group network, the most efficient ways to influence student motivation are through influencing teachers' approachability (*TR3*), and the extent to which he/she would react to acts of discrimination (*TR1*). Likewise, in the minority group network, teachers' approachability (*TR3*) seems to be a very efficient way to influence many aspects of motivation. In addition to similar pathways the majority group network, however, it seems possible to positively influence motivation through talking about different customs and being fair to ethnic others in the minority group network, which are aspects of multicultural education. Most importantly, it seems possible to efficiently increase minority student motivation with a multicultural approach via improving how students get along with each other (*I1*). This seems possible through, again, influencing teachers' approachability and the extent to which he/she would react to acts of discrimination (*TR1, TR3*). Therefore integration appears to mediate the predictive relationship between teacher reactions to victimization and motivation in the minority group (Isvoranu et al., 2016).

Next to our main networks, we have estimated a network of between class effects in order to better account for the multilevel

nature of our data. Our results suggest that on average, in classes where there is a higher minority concentration, teachers talk more about fairness to ethnic others (*ME4*), and children report higher levels of individual and peer-group ethnic victimization (i.e., *IEV2*, *EPGV2* and *EPGV2*). This finding is in line with our network comparison results and results from previous analyses on the data using a multilevel approach (Verkuyten & Thijs, 2002) where minority children report more ethnic victimization when their teacher talked more about fairness to ethnic others (*ME4*), suggesting that multicultural education increases awareness, and knowledge on fairness and negative forms of behavior. Alternatively, there might be more ethnic victimization instances reported in these classrooms due to the higher number of ethnic minorities. As such, teachers may feel the need to talk more about fairness to ethnic others due to the number of reported student experiences. Unfortunately, however, this finding also signals that teachers might not put too much emphasis on multiculturalism within classrooms where there aren't many children from minority backgrounds.

In these classrooms, moreover, children report higher levels of liking of and importance for being part of their ethnic group (ethnic identity items *EI1* and *EI2*), and liking to learn (*M1*). Self-categorization as a group member can lead to self- stereotyping (Hogg & Turner, 1987), and the social groups minority children belong to are often associated with negative stereotypes by the ethnic majority (Brown & Bigler, 2002). A relatively larger in-group size can therefore promote more positive self-evaluations for minorities by decreasing negative self-stereotyping. Furthermore, larger in-group size can protect against ethnic victimization (Verkuyten & Thijs, 2002) and offer more opportunities for developing a sense of ethnic group belongingness (Leonardelli & Loyd, 2016). Therefore, it is reasonable to argue that higher ethnic minority concentration can promote higher levels of liking of and belong- ingness to the ethnic group. As noted earlier, students who feel socially accepted and supported by their peers, in turn, are more likely to be motivated to engage in learning activities (Deci & Ryan, 1985; Kathryn R Wentzel, 2009), findings that are in line with our results.

Considering the pattern of findings, one can arrive at a tenable conclusion considering proximate (immediate) and distal (main) explanations of students' experiences. It is plausible that teachers' multicultural approach constitutes the underlying distal (main) factor of influence over student motivation for both groups, stimulating a positive classroom climate in which students operate (e.g., tolerance). A multicultural approach goes hand in hand with tolerance, acceptance, respect, and affirmation (Nieto, 2002). As it could be expected based on previous literature, students are more motivated in learning environments that are familiar (e.g., culturally) and friendly rather than strange and hostile (Gay, 2004), which can explain why a multicultural approach seems to be beneficial for both groups of students that were included in our analyses.

However, because victimization and social integration are more salient for the minority group children (i.e., central and on the shortest pathway), social integration might constitute a more proximate (more immediate) and direct factor of influence over their motivation compared to teachers' multicultural approach. Given the frequency with which ethnic minority students are victimized (Verkuyten et al., 1997), and the psychological distress that has been found to be caused by negative interactions like peer victi- mization (e.g., Wentzel & Caldwell, 1997), it is not unreasonable that peer relationships would dominate students' classroom ex- periences. Indeed, social interactions with peers have been previously found to shape children's learning processes (Urdan & Schoenfelder, 2006), the quality of which are especially important for students' motivational outcomes (Ryan & Patrick, 2001) that is shaped and maintained by the rules, norms, and behavioral guidelines created by the teachers (Jennings & Greenberg, 2009).

Our findings, however, should be evaluated with caution. Even though these paths highlight potential pathways of influence (Pearl, 2000), our results do not allow for conclusions about causality or directionality[6] as we used cross-sectional data. Therefore, we regard these findings as hypothesis generating and argue that more research is needed in order to directly test such a mediation model as the one described above.

4.4. Strengths

Taken together, we have confidence in the generalizability of our study results. The data we analyzed were originally gathered for a large-scale nation-wide study, providing us with a very large sample size (N = 3806). In our networks, the strength of link between two nodes is a parameter estimated from the data, the accuracy of which rises with increasing sample size (Epskamp & Fried, 2016). Accuracy checks, as reported in the Supplementary materials (see Supplementary Figs. S2–7), also showed a high accuracy and stability in the network structures as well as centrality indices; therefore, low susceptibility to sampling variation. Finally, next to expanding their results, our findings were in line with those of the initial analyses by Verkuyten and Thijs (2002), which is reassuring for our claims that the network approach offers a reliable and time effective tool for exploring data.

4.5. Limitations

As with all research, our study is not without its limitations. First, the data were based on self-report measures and thus might be prone to bias (e.g., demand characteristics, social desirability) especially in relation to sensitive topics as multicultural education and ethnic victimization. Yet, self-reports are suggested to be based on the most valid information available when measuring internal psychological processes (Praetorius, Koch, Scheunpflug, Zeinz, & Dresel, 2017). Moreover, alternative methods such as ethnographic studies (e.g., observation, interviewing) do not reach such great sample sizes due to high resource consumption, which is an

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[6] Yet, based on theory, it makes sense to interpret the direction of the connections. It is, for instance, not very plausible to say that because children are more motivated, they are victimized less. It makes more sense to interpret the directionality of the connection such that because children are victimized less, they are more motivated.

important consideration for network analysis.

Second, the *psychological* network approach has only recently been gaining popularity (e.g., research on psychopathology) and thus is still early in its development. A major current limitation to psychological networks is that it is currently hard to estimate network models while taking multilevel nature of the data into account, especially when aiming to use regularization techniques for model selection (Epskamp et al., 2016). To overcome this limitation, we explored a new method that visualizes between-classroom variance, which also includes a class-level variable 'class composition'. Further methodological work is needed to flesh out network estimation in such complicated multilevel structures. In addition, the LASSO regularization used in this paper has been shown to retrieve network structures well when the true model is sparse (i.e., contains a limited number of edges; Foygel & Drton, 2010), but might perform poorer when the true network structure is not sparse (Epskamp, Kruis, & Marsman, 2017). Furthermore, future research should aim to replicate these results in new samples (Open Science Collaboration, 2015), especially considering the novelty of the methodology. While network architecture has been demonstrated to replicate well, descriptive statistics such as centrality indices may be more prone to differ between samples (Borsboom et al., 2017; Fried et al., 2018; van Loo et al., 2017). Moreover, further developments in bootstrapping are needed, such as investigating the stability of shortest pathways.

Finally, our results were based on a Dutch primary school sample. While our accuracy checks (Supplementary Figs. S2–7) indicate our results' low susceptibility to sampling variation, we acknowledge that this generalizability might still be limited to Dutch primary schools.

4.6. Directions for future research

Follow-up studies may benefit from overcoming the current shortcomings and map out the multicultural classroom interactions in different settings; thus, increasing the prevalence and quality of the application of the psychological network framework to educational research. Importantly, prospective research should directly test the generated mediation hypothesis, which could be done by using structural equation models (SEM) or directed network models (for similarities and differences between the two, see Epskamp, Rhemtulla, & Borsboom, 2017). Similar to SEM, directed networks contain edges with an arrowhead in one end, indicating a one-way effect (as opposed to a mutual relationship), and can be used to depict causal structures (Pearl, 2000).

In addition, expending the research to include not only student perceptions on their peer relationships but also relationships with their teacher might be fruitful. There is evidence indicating that students who have confidence in their teacher in times of stress and need (e.g., victimization) report having high closeness and emotional security levels with their teachers (Zee & Bree, 2017), which in return is beneficial for their classroom engagement and educational performance (for a meta-analysis see Roorda, Koomen, Spilt, & Oort, 2011).

Lastly, future investigators can construct separate networks for teacher and student views as teachers consistently perceive their classrooms' climate more positively than their students, a phenomenon called "the rose-colored glasses" (Hofman, Hofman, & Guldemond, 2001). Comparison of such networks could give us insights as to where teachers might need to reassess their perceptions to better fulfill the needs of a diverse student body.

4.7. Implications for education

While support for multiculturalism and multicultural policies are showing modest increases in most parts of Europe (Banting & Kymlicka, 2013), more often than not, teachers perceive the application of these practices as an additional "burden" to their everyday practices and curriculum (Gay, 2004). This is either due to not receiving any training as to how they can deal with diversity in their classrooms or not being completely convinced of the benefits of a multicultural approach (Verkuyten & Thijs, 2013). Our results, however, show how important a multicultural approach is for peer relationships and student motivation. More specifically, our findings signal the need to not only ensure non-victimization in the classrooms but also to better reflect the unique needs of minority students and to promote positive relationships by engaging in multicultural educational practices (Banting & Kymlicka, 2013).

The insights gained from our network analyses can be used to inform diversity training that would both communicate the benefits of a multicultural approach and would empower and motivate teachers to be more mindful of creating and maintaining positive and fair peer relationships. As part of their professional development, teachers can receive a training that targets the most central nodes in the networks, and/or the edges that are on the shortest pathways of influence over motivation (Isvoranu, Boyette, Guloksuz, & Borsboom, 2017). Targeting these would be the most efficient ways to influence many aspects of the classroom dynamics at once.

Based on our findings, targeting the central nodes and/or the edges on the pathways calls for increasing teacher approachability about acts of victimization, the extent to which they interfere with these acts, the extent to which they explicitly communicate that fairness towards people that are culturally and/or ethnically different is important, and enhancing social integration, of especially ethnic minorities, with their class-group. Therefore, such trainings could benefit from including lessons on, for instance, exhibiting more approachable body and facial expressions (Willis, Palermo, & Burke, 2011), familiarizing oneself on emotional display rules of different cultures to better read social situations (Fischer & Manstead, 2008), engaging in role-playing in order to increase perspective taking abilities (Stephan & Finlay, 1999), incorporating cultural issues into instruction (Gay, 2004), and increasing contact between groups to reduce prejudice and increase integration (Allport, 1954). To make it more concrete, a previously suggested strategy to incorporate cultural issues into instruction, for instance, is to give students an exercise on writing a persuasive essay about social justice concerns and issues (Gay, 2004).

5. Conclusion

To the best of our knowledge, the current study is the first to apply the *psychological* network approach to educational research. This approach allowed us to explore the specific aspects of classroom interactions that relate to students' motivation. Our study's comparative nature yielded different possible pathways of influence from teachers' multicultural approach to student motivation for different ethnic groups of children. Our results speak to the need for further understanding the relationship between the two challenges minority children experience, namely social integration and educational achievement.

Supplementary data to this article can be found online at https://doi.org/10.1016/j.jsp.2019.02.003.

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