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Personality-sensitive pedagogies: A study of small group interactive behaviours among 9- to 10-year-olds

Marcus Witt[1] | **Ben Knight**[1] | **Tom Booth**[2]

[1]University of the West of England, Bristol, UK

[2]University of Edinburgh, Edinburgh, UK

Correspondence
Marcus Witt, University of the West of England (S Block), Frenchay Campus, Coldharbour Lane, Bristol BS16 1QY, UK.
Email: marcus.witt@uwe.ac.uk

Funding information
University of the West of England

Abstract

The learning and social development benefits associated with pupils collaborating in small groups have been well documented over recent decades; however, research exploring personality as a mediating factor in small group learning is sparse. In this study we identified pupils who self-reported low levels of extraversion and/or high levels of neuroticism (tendency to worry) as personality traits and observed them working in small group collaborative learning situations. Using mixed methods social network analysis as a way of understanding group interactions, we combined a degree centrality measure and a novel concept of 'provocatory participation' with a qualitative analysis of group interactions. Data integration facilitated in-depth interpretations of relationships between personality and pupil interactions. Findings suggest that low levels of extraversion and/or high levels of neuroticism can be, but are not always, associated with lower levels of participation and that a range of other factors, notably the personality traits of all pupils in a small group, affect participation. These findings are used to suggest ways that teachers could employ more personality-sensitive pedagogies, particularly with respect to small group activities.

KEYWORDS

collaboration, group work, personality, social-network-analysis, talk

Key insights

What is the main issue that the paper addresses?

The paper explores the possible role personality plays in collaborative group work. Specifically, it explores the possibility that children who score low for extraversion and high for neuroticism (more prone to anxiety) participate less in collaborative groups and, if so, the factors that cause or mediate this.

What are the main insights that the paper provides?

The role of personality in group learning is complex; children with similar personality types did not always have the same kinds of interactions. Personality is a useful factor in examining group processes and can lead to insights for classroom practitioners to increase efficacy and equality of participation.

INTRODUCTION

In primary school classrooms in the UK, pupils spend a great deal of time working collaboratively in small groups (Kutnick et al., 2002). Riordan et al. (2024) note that through a typical school day pupils regularly group and 'ungroup' themselves for a variety of tasks and in various contexts. However, research shows that the efficacy of group work is mixed (Nokes-Malac et al., 2015). There is evidence that collaborative group work can have clear learning benefits (e.g. Laal & Ghosi, 2012) and according to the Education Endowment Foundation (EEF, 2023) collaborative group approaches show consistently positive impacts on learning. However, group processes such as 'social loafing' (group members working less hard owing to the assumption that others will compensate) and fear of evaluation can lead to inefficient or even counter-productive group working (Nokes-Malac et al., 2015). Mercer (2008) outlines the importance of collaborative talk in developing pupils' reasoning. Littleton and Mercer (2013) found that group work has the potential to be highly beneficial for learning but is often highly ineffective in reality. They explore the importance of 'interthinking' (pupils collaborating and talking together in a productive way) to enhance learning and understanding. This is supported by Wells (2007), who argues for encouraging learners to engage in dialogue to construct knowledge together. There are, therefore, several factors that might determine the efficacy of group interactions.

Implied throughout the literature on peer classroom interaction, and argued for explicitly by some, is the importance of equitable participation. For example, Webb (1995, p. 243) argues that active involvement across a group increases productivity and Littleton and Mercer's (2013) 'Exploratory Talk' highlights the value of constructive critical discourse, idea and knowledge sharing across a group, while Johnson and Johnson's (2002) 'positive interdependence' emphasises that in collaborative group work, no member can succeed unless all members succeed. This presents a challenge for teachers since, owing to various factors, not all pupils are equally comfortable or confident participating in group work (Ogden, 2000). For example, pupils can dominate group processes, or isolate themselves (Blatchford et al., 2006), participation and productivity can suffer owing to internal dynamics (Johnson & Johnson, 1985) and disengagement levels can be high among higher attaining pupils since evidence suggests that group work typically offers them insufficient stimulus (Office for Standards in Education, 2013). While convincing arguments for its effectiveness

are widespread, group work does not per se guarantee equal participation or learning. Identifying factors that may help facilitate equitable and productive participation may therefore be important for pupil outcomes (McAllister, 1995). Kutnick and Blatchford (2014) argue that group work is most effective when pupil groupings have a clear theoretical basis (i.e. deliberately conceived by teachers). In this paper we argue that pupils' personality profiles are one factor (among several) worthy of consideration when forming groups and coaching pupils in group processes.

Pupils' personalities are an under-researched area and is important for understanding group interactions. Recognising pupils' differences and developing adaptive teaching practices is currently a critical issue in English education policy and in teacher education (DfE, 2011, 2019a, 2019b). However, focus currently rests predominantly on differences arising from special educational needs and disabilities and demographic and identity differences, including race (Packard, 2013), gender (McQuillan & Leininger, 2020) religion (Kienstra et al., 2019) and language (Strand & Hessel, 2018). Despite its ubiquity across the education system (Hughes et al., 2021; Roemer et al., 2022), personality diversity remains largely absent from current discourse on learner diversity and conceptions of classroom 'difference'. This is despite evidence linking personality traits to school outcomes (Neuenschwander et al., 2013; Noftle & Robins, 2007; Poropat, 2014), cognitive ability (Brandt et al., 2020) and subject-specific competencies (Roemer et al., 2022), and studies in adults (e.g. Chamorro-Premuzic & Furnham, 2003; Parks, 2018) demonstrating that personality exerts considerable influence on group interaction and outcomes.

One common framework for applied research on personality is the Five Factor Model (FFM; known colloquially as the 'Big Five'—de Raad & Mlacic, 2015). The FFM is the dominant hierarchical descriptive taxonomy of personality traits that has been widely used across multiple disciplines (McCrae & Terracciano, 2005) and is predictive of a wide variety of outcomes (Roberts et al., 2007). The FFM consists of five broad domains: Openness, Extraversion, Conscientiousness, Agreeableness and Neuroticism. Each is argued to subsume a set of narrower characteristics. Whilst there remains debate on the exact number and organisation of personality traits (e.g. Condon et al., 2022; Irwing et al., 2023), for the current study, we adopt the domains of the FFM given the extant evidence of their reliability and utility.

Each of the domains and facets is designed to assess a trait continuum, from 'low' to 'high'. The combination of the FFM domains produces a trait profile for a given individual. Trait profiles are thought to capture stable psychological attributes that remain relatively constant into and throughout adulthood (Caspi et al., 2005; Cobb-Clark & Schurer, 2012). Importantly for the current study, reliable evidence shows that trait profiles are sufficiently stable by middle childhood (Barbaranelli et al., 2003). Trait profiles have been explored as a mediating factor in primary aged pupils' learning behaviours and outcomes (Anderson et al., 2020; Measelle et al., 2005).

Of interest in this study were the impacts of, and interactions between, all five personality traits on pupils notably low in extraversion and high in neuroticism (our focus pupils, or FPs). Individuals low in extraversion are typically more reserved, draw energy from their internal mental worlds and prefer low stimulation contexts. Individuals high in neuroticism tend to lack emotional stability, respond negatively to stressful situations and worry about how others perceive them. We aimed to explore how these pupils interacted with their peers in group-learning situations with reference to all of the FFM traits.

Low extraversion (introversion) and high neuroticism, a trait combination colloquially identified as 'shy', have been shown to correlate with poorer academic outcomes (Chamorro-Premuzic & Furnham, 2003; Mjelve et al., 2019). Komarraju et al. (2011) have also suggested that higher neuroticism is associated with lower academic performance. According to Mjelve et al. (2019), in the classroom, shy pupils display several psychosocial vulnerabilities,

including working hard to avoid making mistakes, seeking stability, an over-dependence on adults and fearfulness. According to Jones and Gerig (1994), shy pupils simply say less in the classroom. Shyness has also been explored in relation to group interactions. Chen et al. (2021) investigated the role of friendship in shy pupils' interactions, finding evidence that it can mitigate the negative effects of shyness on learning. A meta-analysis by Cordier et al. (2021) showed that many of the challenges that shy pupils face reveal themselves in school precisely because of the central role of interaction in classroom learning. According to Cordier et al., avoiding becoming the centre of attention is important for shy pupils, which presents a challenge in the context of group work where equal contributions to shared goals are expected.

Evidence suggests that Western education systems are biased towards extraversion. Research by Meisgeier et al. (1994) found that 76% of teachers, regardless of their personality, considered extraversion the 'ideal' trait for students. This unconscious bias may create suboptimal learning environments for introverted pupils, as teachers often design their classrooms and learning opportunities based on these 'ideal' characteristics.

Despite evidence of the importance of personality for educational and group outcomes, no studies have examined personality as a mediator of small group collaboration from a learning perspective. Roemer, Lechner & Rammstedt (2022, p. 1) have argued for the importance of more 'fine-grained' personality-based research. Therefore, drawing on the well-established assertion that active participation in group learning is desirable, this study analysed FPs' interactions with their peers in small groups.

Accepting the assertion that active participation in group collaboration is essential for learning, and that equal (or close to equal) participation is optimal, the research questions were:

1. Are FPs less influential/do they participate less in group interactions than their peers?
2. What personality factors influence the centrality of FPs within their small groups?
3. Could the findings help teachers introduce more personality-sensitive pedagogies?

Based on FFM traits and related studies, we expected FPs to have fewer peer interactions and less centrality in small group networks. This pilot study aimed to inform a larger study's design and build an evidence base for personality-sensitive small-group teaching recommendations for teachers and teacher educators.

METHODOLOGY AND METHODS

Sampling

The FFM personality profiles of 24 year 5 pupils (ages 9–10) from a primary school in south-west England were obtained via a self-report survey. Pupils scoring low in extraversion or high in neuroticism were identified as FPs and video-recorded collaborating with their peers in small groups on a non-cognitive task. This task was designed to avoid the potentially confounding influence of confidence or competence in specific curriculum areas on participation.

Personality data collection

Personality data were collected using the Pictorial Personality Traits Questionnaire for Children (Mackiewicz & Cieciuch, 2016). This adaptation of Barbaranelli et al.'s (2003) 65

statement questionnaire aimed at adolescents is based on pictures rather than text questions, which Mackiewicz and Cieciuch (2016) argue demands less abstract reasoning, making it appropriate for children as young as 7 years who in Piagetian terms are at the stage of 'concrete operations'. The instrument was therefore well suited to our sample of 9 and 10 year olds.

Pupils answered 15 questions by selecting how they would respond to different scenarios, each illustrated with a picture and a brief sentence (see Figure 1). Each of the five FFM personality traits was assessed in three scenarios. Participants chose one of two outcomes and rated the likelihood of their response. Scores were adjusted so that higher scores indicated stronger traits, ranging from 3 to 15 per trait. The class teacher, familiar with the pupils, administered the questionnaires during a 15 minute period, with a teaching assistant available to help with any reading difficulties.

Recognising the limitations of self-reported personality data, particularly for extraversion where pupils might indicate how they wish they would act, rather than how they would act in reality, we included corroborating measures. Pupils completed the Strengths and Difficulties Questionnaire (part of the Development & Wellbeing Assessment, Goodman & Goodman, 2012), which, despite not mapping precisely onto the FFM model, includes a 'worried' factor to support high neuroticism scores from the Pictorial Personality Traits Questionnaire for Children. Additionally, the class teacher identified pupils she observed as introverted or anxious. Despite some inevitable subjectivity, triangulating these three data points was essential for identifying the FPs.

In cases where teacher judgement and pupils' self-reports differed, we prioritised extraversion. For example, Amelia (Table 1), who reported low extraversion, but was not identified as such by the teacher, was designated an FP. In contrast, Irene, whom the teacher suggested had high neuroticism but also high extraversion, was not. Lamiz was designated an FP based on the teacher's identification of her high neuroticism and low extraversion, despite her self-reports indicating neither of these.

Small group video data collection

Following the identification of the FPs, small groups were filmed completing a short non-cognitive collaborative task. This was done in a separate room, away from the main classroom to avoid background noise. Episodes varied in length from 7 to 17 min, depending on how quickly the groups completed them (see Table 1). The eight groups, each with three to five pupils (mostly four), included one or two FPs. Their task was to use building blocks to construct a castle with specific characteristics (height, staircase and appropriately sized entrance for a

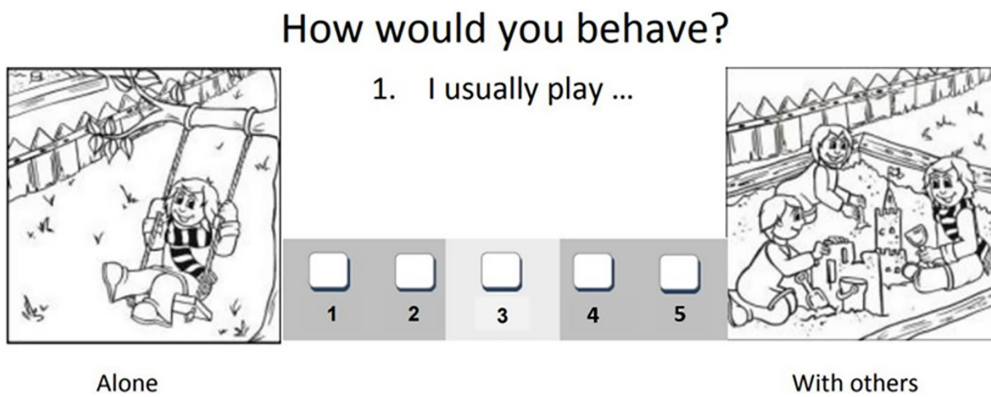

FIGURE 1 Example question from the Pictorial Personality Traits Questionnaire for Children questionnaire. [Colour figure can be viewed at wileyonlinelibrary.com]

TABLE 1 Personality and provocatory participation (PP) data for heterogeneous (Groups 1–6) and homogenous (Groups 7 and 8) groups.

Name and ranking	Provocatory participation	Personality scores					Teacher assess	Participation rate
		E	N	O	C	A		
Group 1 (*heterogenous*) *task length: 17 min*								
Rosy	117	14	9	12	7	12		6.5
Irene	108	10	9	11	10	9	N	6.0
Amelia*	81	7	7	14	11	8		4.5
Group 2 (*heterogenous*) *task length: 13 min*								
Karina*	62	6	10	11	13	10	Low E;N	4.8
Nigel	54	14	8	7	11	5		4.2
Darren	40	11	9	10	9	9		3.1
Sophie*	15	7	6	10	12	8	Low E	1.2
Group 3 (*heterogenous*) *task length: 14 min*								
Ian*	74	8	11	8	10	9		5.3
Gordon	71	14	6	8	12	8		5.1
Veronica	40	12	6	11	11	13	Low E	2.9
Belinda	28	10	7	11	8	10		2.0
Group 4 (*heterogenous*) *task length: 14 min*								
Dylan	81	10	8	11	6	10		5.8
Melinda	64	9	9	9	9	9		4.6
Laura*	45	5	9	7	6	8	Low E;N	3.2
Larry	36	11	9	12	10	9		2.6
Group 5 (*heterogenous*) *task length: 16 min*								
Leah*	97	7	9	9	12	10	Low E;N	6.1
Fay	96	10	12	14	13	14		6.0
John	33	10	6	8	8	10		2.1
Assif	25	9	7	6	9	5		1.6
Group 6 (*heterogenous*) *task length: 9 min*								
Anna	96	10	9	10	5	6		10.7
Amina	49	12	13	11	15	14		5.4
Zak	42	13	6	8	8	3		4.7
Mina	33	10	8	13	12	14		3.7
Lamiz*	32	13	10	9	10	10	Low E;N	3.6
Group 7 (*homogeneous*) *task length: 7 min*								
Ian*	31	8	11	8	10	9		4.4
Laura*	30	5	9	7	6	8	Low E;N	4.3
Leah*	25	7	9	9	12	10	Low E;N	3.6
Karina*	25	6	10	11	13	10	Low E;N	3.6
Group 8 (*homogeneous*) *task length: 9 min*								
Karina*	46	6	10	11	13	10	Low E;N	5.1
Leah*	45	7	9	9	12	10	Low E;N	5.0
Lamiz*	28	13	10	9	10	10	Low E;N	3.1

Note: Metrics left to right: PP, FFM trait scores, teacher assessment of low extroversion (low E) and/or high neuroticism (N) and participation rate (incoming utterances/episode length in minutes).

*indicates Focus Pupils (FPs).

plastic figure; see Figure 2). The non-cognitive nature of the task was chosen specifically so that confidence in a particular academic domain did not confound the role of personality in the pupils' participation. Personality is one of several factors that influence classroom interactions and was the focus of this study. A greater understanding of the role of personality, while not offering a full explanation of classroom interactions, may enable teachers to make more informed pedagogical decisions. Pupils were given up to 15 min to complete the task. No adult was present as the children collaborated, but pupils were aware that they were being filmed. In total eight groups were recorded. Each recording will, from here, be referred to as an 'episode'.

The first six groups had one or two FPs and two to four peers, creating heterogeneous personality groupings. In the final two episodes, we repeated the exercise with a slightly altered task (building a bridge in Group 7 and a castle within a moat with bridges in Group 8) using homogeneous groups composed entirely of FPs. This allowed us to compare equitable participation in heterogeneous vs. homogeneous groups, examine how FPs participate with similar peers and explore what, if any, relationships exist between an individual's traits and the composition of the rest of the group. The eight episodes yielded about 120 min of footage and approximately 2800 interactions. Pseudonyms are used for all participants.

Data analysis

Social network analysis (SNA) investigates relationships and social structures (Froehlich et al., 2020), providing data on network characteristics such as connection strength, density and influence concentrations. Existing SNA datasets are typically quantitative (e.g. Mameli et al., 2015), derived from large-scale data (e.g. social media networks) focusing on relational structures. Some studies have applied SNA to classroom interactions (e.g. Grunspan et al., 2014; Mameli et al., 2015) using video observation rather than surveys (e.g. Bockhove, 2018; Pomian et al., 2017). In this study, we used SNA across all eight episodes to analyse interaction direction, frequency, pupil centrality (degree centrality) and a novel metric for ignored interaction attempts (ignored factor, IF). Degree centrality, which measures the extent to which individual nodes in a network are connected to one another, was chosen as the most appropriate centrality measure. In this study, connectedness was via interactions, predominantly verbal utterances. Other common centrality measures, including betweenness (how often a node is the shortest path between other nodes) and closeness (how close or distant nodes are) would not have shown the density of pupils' participation. Centrality rankings were derived according to individuals' total incoming utterances (in-degree) and described using the novel concept 'provocatory participation' (PP), which assumes that pupils receiving the most incoming utterances have 'provoked' the attention and interaction of their peers. Comparing PP levels of pupils within each network therefore became our primary measure of participation and the basis for the rankings shown in Table 1.

FIGURE 2 Examples of outcomes from the non-cognitive small group videoed task. [Colour figure can be viewed at wileyonlinelibrary.com]

Provocatory participation

The decision to use incoming utterances as a measure of network centrality was based on the principle that a pupil's active participation would provoke incoming utterances from others, whereas peripheral participation would result in fewer incoming utterances. For instance, pupils who made suggestions, asked questions or actively engaged in building would provoke interactions and incoming utterances from their peers.

Using the traditional 'net in-degree' centrality measure, which subtracts outgoing utterances from incoming ones, would have been misleading for pupils who participated minimally and spoke infrequently. These pupils would receive a small positive in-degree score. Conversely, highly participatory pupils with many outgoing utterances might receive a small or negative net in-degree score owing to their high outgoing utterance count. Given our principle that participation provokes incoming utterances, we felt that focusing solely on incoming utterances provided a clearer picture of participation. Individuals' centrality within their small group networks was thus determined by their PP, which became synonymous with centrality in this study. From here on, we refer to this metric as PP.

It is crucial to clarify that PP does not imply participation in support of the shared goal. We chose to include all utterances in the analysis, not just those related to the task, to provide a comprehensive view of the network. This approach allows pupils ranked high for PP to have participated in ways that may not align with the task's objectives, as well as those that do. Therefore, PP rankings reflect how much individuals drew attention from their peers and do not necessarily indicate their contribution to the task. This underscores the importance of our mixed methods design, as PP rankings alone do not reveal how task-oriented each pupil's contributions were.

A common critique of SNA is its lack of attention to the qualitative nature of the interactions it seeks to model (Fuhse & Mützel, 2011; Hollstein, 2011). Froehlich et al. (2020) have proposed the idea of mixed methods social network analysis (MMSNA) as a way of exploring both the relationship between content and group dynamics and the meaning-related structural dynamics (Bruun et al., 2019). We adopted this approach to ensure that salient features of the group interactions not coded quantitatively (body-language, pupil positioning, vocabulary or other contextual factors) were captured and integrated. Given our interest in the personality profiles of the participants, we aimed to explore not only who was participatory within the network, or not, but how the personality profiles of the FPs and their peers may have influenced their PP (RQ2). A purely quantitative or qualitative approach would not have achieved this. Quantitative and qualitative coding protocols are explained below.

Quantitative coding protocols

Initially, the nature and intended target of each utterance were coded. Utterances were defined as 'a single unit of speech spoken without interruption by an individual for an obvious audience'.

The following protocols were created to further refine this definition in the interest of precision:

- if one utterance is bisected by another including a pause (i.e. turn taking)—coded as two utterances;
- when two different ideas are expressed back-to-back—coded as two utterances;
- utterances do not include screeches, howls, speaking to oneself (externalising internal monologue, singing to oneself, etc., unless accompanied by a clear action indicating an audience); and

- exact consecutive repetitions—coded as two utterances.

Each video episode was watched once through in its entirety by the two researchers independently for the purposes of familiarisation. Following this, each episode was watched several times by the researchers together. During each viewing, attention was focused on a single child and their utterances were allocated one of the following three codes:

- *to XXXX*—To a specific member of the group (the intended target of the utterance was recorded);
- *ether–response*—To nobody in particular (into the 'ether') which did elicit a response; and
- *ether–no response*—to nobody in particular (into the 'ether') which did not elicit a response.

Disagreements between the researchers about an utterance (e.g. whether it had an intended target or was to the 'ether') were resolved by re-watching the utterance, looking at the body language of the other pupils, the context in which the utterance was made and the nature of preceding utterances. After consideration of these factors, a judgement was made.

As a novel innovation in small group SNA analysis, we also created a measure of the extent to which each pupil was ignored by their peers and referred to this as an individual's IF. The IF was calculated by dividing the number of utterances to 'the ether' that did not garner a response by the total number of utterances to the ether. This was then expressed as a percentage. For example, a child who made 40 utterances to the ether, 30 of which received no response would have an IF of 75%. To facilitate comparison of absolute participation between pupils in different groups, 'participation rates' were calculated by dividing each pupil's incoming utterances by the episode length rounded to the nearest minute (Table 1).

Qualitative coding protocols

Each episode was re-watched in its entirety by both researchers (this time independently) seeking explanations for questions raised by the quantitative data, for example, why a particular FP had the highest PP ranking in a given episode or what might explain the sudden drop-off in participation of a FP during an episode. The following coding frame, derived from prior viewings of the episodes, was used:

- the nature of the language used (i.e. the person of the verb (I, you, we), suggestions or imperative, questions or answers);
- body language;
- position in the room and relative to other pupils;
- on-task and off-task behaviours;
- interactions with/control of resources;
- interactive dynamics suggestive of prior relationships; and
- other (novel criteria which emerged during the qualitative viewing of the episodes).

In the interests of credibility and rigour (Yin, 1994), 'systematicity' (O'Connor & Joffe, 2020) and consistency (Kahng et al., 2011) of the research, having separately analysed each episode using the above codes, the researchers compared alignment of their interpretations through a process of inter-observer agreement (Hausman et al., 2021). This involved identifying (per episode) significant instances in which the above codes were noted to influence interactive behaviours. Instances were compared and categorised as having strong, moderate or weak interpretive alignment between researchers. Novel codes emerging from the

analysis ('other' in the above coding list) were compared and added to create a refined set of codes which were applied to a subsequent joint viewing of each episode.

Questions raised by the quantitative network analysis and the personality data (e.g. why FPs were not ranked uniformly low or high or how all FFM traits influence participation) prompted us to analyse episodes qualitatively. Similarly, the qualitative analysis prompted continual cross-referencing of the quantitative data. In this way, the findings were the result of comprehensively integrated analysis (Fetters & Freshwater, 2015).

RESULTS

The next section begins with combined personality and SNA quantitative data for all eight groups (six heterogeneous, two homogeneous), followed by discussion of results in relation to research questions. The MMSNA results are then presented as three vignettes: (i) heterogeneous Group 2; (ii) heterogeneous Group 4; and (iii) homogeneous Groups 7 and 8, demonstrating integration of quantitative and qualitative data to address research questions. Finally, overall findings are presented and discussed.

Quantitative data

Personality and SNA data for the six heterogeneous and two homogeneous groups are presented in Tables 1 and 2. The pupil reporting the lowest score for extraversion had the lowest PP ranking in only two out of six heterogeneous episodes when FPs were grouped with non-FP peers. Similarly, there is no clear relationship between neuroticism and PP rankings. No clear relationship was evident between low extraversion, high neuroticism and PP. However, in the six heterogeneous episodes, the IF metric showed that the FP in each group was the most ignored in four out of the six episodes. Therefore, with respect to research question 1, the quantitative data indicate inconsistent relationships between FP classification and participation.

Leah (Group 5) and Karina (Group 2), despite having low extraversion and high neuroticism scores, received the most incoming utterances and were therefore deemed to be the most participatory members in their respective groups. However, Sophie (Group 2), Laura (Group 4) and Lamiz (Group 6), who were also identified as being low in extraversion (Lamiz's self-report was at odds with her teacher assessment), provoked considerably fewer interactions than their group peers.

In some groups, IF (see Table 2) corresponded closely to the PP rankings, i.e. the pupil with the highest number of incoming utterances was also ignored the least (e.g. in Groups 1–4). Again, this was not always the case. In Group 3, for example, Gordon was ignored more often than Veronica, although he was ranked higher for PP. This suggests that the number of incoming utterances and IF are not measuring precisely the same thing. There were pupils (e.g. Larry in Group 4) who seemed to participate very little, who generated few incoming utterances but whose IF was also low. This suggests that there are pupils who say little, but when they do speak up, are rarely ignored.

MMSNA: integrating qualitative and quantitative insights

Vignette 1: Group 2 (heterogeneous)—quantitative data

Four pupils completed the task in this episode. Table 1 shows their personality and PP data and Table 2 shows their outgoing utterance and IF data. Two of the four pupils (Karina and Sophie) in Group 2 were identified as FPs. Sophie had a low extroversion self-report and

TABLE 2 Outgoing utterance code and ignored factor (IF) data for heterogeneous and homogeneous groups.

Name and ranking	Outgoing to specific others	Ether–response (ER)	Ether–no response (ENR)	Ignored factor (%)
Group 1				
Rosy	48	26	42	62.7
Irene*	57	24	48	63.7
Amelia	21	15	51	77.3
Group 2				
Karina*	20	24	16	40.0
Nigel	32	17	13	43.3
Darren	33	12	26	68.4
Sophie*	27	6	24	80.0
Group 3				
Ian*	43	25	27	51.9
Gordon	52	6	16	72.7
Veronica	52	8	15	62.5
Belinda	25	2	6	75.0
Group 4				
Dylan	41	19	11	36.7
Melinda	65	17	16	45.8
Laura*	27	13	14	51.9
Larry	36	8	5	38.5
Group 5				
Leah*	65	9	5	35.7
Fay	63	11	3	21.4
John	33	7	10	58.8
Assif	60	3	2	40.0
Group 6				
Anna	62	16	11	40.7
Amina	51	1	3	75.0
Zak	16	1	0	0
Mina	58	1	1	50.0
Lamiz*	41	1	4	80.0
Group 7 (*Homogeneous*)				
Ian	13	11	7	38.9
Laura	26	6	2	25.0
Leah	25	2	2	50
Karina	24	4	2	33.3
Group 8 (*Homogeneous*)				
Karina	41 (41)	4	1	20.0
Leah	43 (41)	2	0	0
Lamiz	30 (21)	3	0	0

*indicates Focus Pupils (FPs).

Karina reported low extraversion and relatively high neuroticism. The class teacher identified Karina as being both low in extraversion and prone to worry (high in neuroticism) and Sophie as low in extraversion. Sophie (consistent with her low extraversion self-report) said little, was largely ignored and exerted little influence on the group. Karina, however, with similar personality traits, participated much more and exerted a greater influence on the group. Their personality traits are similar for all five factors (except neuroticism), with Karina rating herself as considerably more prone to worry. In the episode, Sophie, while very much on the periphery, seemed unperturbed by this. Karina seemed more determined to participate. Looking at both pupils' trait profiles, we speculate that neuroticism, rather than extraversion, may be the factor more predictive of participation. The next section explores more possible reasons for the participatory differences between Karina and Sophie through qualitative analysis of the same episode.

Vignette 1: Group 2 (heterogeneous)—qualitative data

Quantitative analysis of the network structure gave rise to the following question: what enabled Karina to show higher PP than Sophie? Analysis of the language used by the two revealed distinct patterns in their utterances. Sophie's utterances were almost all commentary, or a repetition of something that someone else had said:

> That's a good archway;
>
> Yes, we should.

Karina, on the other hand, made several suggestions. She did not use imperative language but couched her utterances in the third person plural (we) and often with a modifier such as 'maybe', 'shall we', 'What if we'.

> Shall we do a height test and a fit test?
>
> What if we make it like a Jenga structure going up, across, up across?

Karina's self-report personality data suggest that she is highly agreeable, a trait typified by being keen to please others and conflict averse. During the episode, she acted as peacemaker when Darren knocked part of the tower over, Nigel admonished him and it appeared that an argument might have ensued. Karina stepped in to ensure that the group remained cohesive, using verbs in the third person plural and reassuring the whole group that the setback was not serious.

> It's not serious. We still have some minutes left. We shouldn't punish each other for our actions.

Her peacemaking intervention seemed to increase her influence and particularly Nigel's receptiveness towards her suggestions.

In seeking to understand some of the utterances and behaviours of the participants, the personality traits of the non-FPs were also considered. Nigel, ranked second for PP and quite dominant, was notably low in both openness (7) and in agreeableness (5). His lack of openness was clear in the language that he used. He often began his utterances by refuting a suggestion from one of the others;

We're not measuring yet! [Forcibly taking the measuring stick from Darren.]

Nah, nah, nah, let's make it build up with this.

Nigel's lack of agreeableness was evident as he confidently pursued his own ideas for the task, often disregarding his peers' suggestions without concern for their approval. This behaviour was underscored by non-verbal actions, such as removing a block placed by Sophie, which seemed to discourage her from further verbal or non-verbal interaction.

Karina demonstrated increased participation by taking control of important resources, such as a metre stick provided for measuring the castle's height. It could be that her high conscientiousness, possibly heightened by neuroticism, motivated her to ensure that the group adhered to the task requirements and performed well.

Vignette 2: Group 4 (heterogeneous)—quantitative data

Four pupils completed the task in this episode. The pupils' self-report neuroticism scores were very similar (9, 9, 9, 8). What distinguished the FP (Laura) from her peers was her low self-report for extroversion and a relatively high score for neuroticism (as well as a relatively high 'worried' score in the Strengths and Difficulties questionnaire). These self-report scores were corroborated by the class teacher, who assessed her as being low in extroversion and prone to worry. Laura was ranked third of the four children for PP with the two most influential children (Dylan and Melinda) both provoking considerably more incoming utterances than the other two (Laura and Larry). It is notable too that Laura made the fewest utterances of anyone in the group and had the highest IF (almost 52%).

Her self-reports also made Laura the least open, least agreeable and jointly least conscientious of all the group members. The quantitative data paint a picture of a child whose personality profile might make her unable and/or unwilling to play a meaningful role in group learning situations and therefore at risk of isolation and not being included. Her low self-reported score for conscientiousness suggests a child who might find it difficult to remain on task, particularly if efforts to become involved are met with silence and isolation. Despite being in a group with other children who were relatively open and agreeable, Laura still struggled to provoke incoming utterances and to avoid being ignored. Below we explore in more detail the nature of the interactions in this episode.

Vignette 2: Group 4 (heterogeneous)—qualitative data

Dylan and Melinda, the two highest ranked for PP, established themselves as leaders of the task from the outset, but without any dominant or anti-social behaviours. Similarly to Group 2, the child ranked highest for PP (Dylan) used a lot of inclusive, first person plural language:

We should try …

How about we plan a consistent way …?

We are actually being scientists right now.

This may be indicative of his high self-reports for openness and agreeableness. However, the child ranked second for PP (Melinda), also used some imperative language:

We're going to do this …

We're not doing that …

and was keen to approach the task in a structured way.

Laura displayed frequent immature, flighty, off-task and erratic behaviours indicative of high neuroticism. She also frequently made utterances not relevant to the task. Her several attempts to integrate herself into the group, particularly at the beginning, met with limited success; therefore her focus and investment in the collective task and cooperation with her peers fluctuated considerably and tapered to almost nothing before the end of the episode. Laura frequently subordinated herself to Dylan and sought attention from the others (with some success) through making silly voices, disruptive and impulsive behaviours, and conduct associated with emotional instability and stress. Her position in the room and at the task table was erratic. Her interaction with the resources was often in support of the others (e.g. making bricks available) and she was isolated for prolonged periods (e.g. playing alone with the bricks).

Behaviours indicative of neuroticism were also evident from non-FP members of the group. Dylan and Melinda, for example, were clearly anxious about the quality of the task and wanted the group to succeed. Larry said very little, was not confident interacting and predominantly busied himself with doing, rather than talking. Larry's few outgoing utterances explain his bottom ranking for PP. He said little and his few utterances were mostly agreements with others' utterances. However, he did participate proactively through building the castle throughout the episode, although these contributions were largely accepted by the group and did not provoke questions, disagreements or discussion. He remained on task throughout the episode and rarely drew attention to himself or his actions. In contrast, Laura made rare physical contributions to the building task. Her higher PP ranking was derived almost entirely from disruptive behaviours which provoked remonstrations from her peers, with Dylan describing her as 'weird'. Similar behaviours were observed from the FP in Group 3, who was ranked highest for PP because almost all his considerable utterances were off-task and subversive, provoking appeals from his peers to calm down and participate constructively (See Table 3).

A final observation of note from this episode was the pre-existing credentials which Dylan and Mia possessed, and which influenced how Larry and Laura positioned themselves from the outset. It was evidently known that Dylan was intellectual, interested and capable in science and that Mia's father worked at the local science museum. The following exchange occurred 4 min into the 14 min episode:

Mia: My dad's taught me a load about construction. I don't know as much as you expect a proper scientist to know, I just know a bit about designing because my dad's a manager of a science museum.
Laura: Luckily we have a proper scientist in the room, Dylan (putting arm around Dylan's shoulder).
Mia to Dylan: You're a computer scientist, aren't you?
Dylan: I also know quite a bit about, well, everything about science and maths.

While not on the surface personality-related, these already known facts about Dylan and Mia afforded them a certain status in the group and may go some way to explaining their immediate confidence and leadership of the task, their frequent consultations with one another about the task and the subordinate position adopted by Laura with respect to them

TABLE 3 Qualitative observation notes for heterogeneous Groups 1, 3, 5 and 6 (non-vignette).

Group 1
2 + 1 dynamic prevalent (Rosy and Irene together, Amelia separate) Rosy uses plural language 'we' Amelia uses 'I'. Rosy occasionally uses second person (you) for instructions/directing others. She is the only one to do this. Rosy makes many suggestions, and has the floor to herself. Rosy's language mirrors 2 + 1 separation. (If you use the blocks, we can't.) Amelia self-isolates, rather than being forced to isolate. She invites this by moving off to the side, doing her own thing. Amelia, unlike Ian in Group 3, is unperturbed by her separation from the group. Openness of Rosy and Irene eventually allows Amelia to integrate. There are high levels of openness in the group, so little is rebuffed.
Group 3 More off task behaviour (Ian) in this group than others. G took control of resources and building process. Ian (high N) attempts to get involved offering to find blocks. Seems to lack confidence to engage in building—voluntarily relegates himself to subservient role. Ian's attempts to become involved mostly ignored by G (low O). Ian begins to lose focus and engage in off-task behaviour, gaining more PP from peers (fuelling his off-task behaviours). Others seem content with this. There are periods where the rest of the group becomes more task focused. At these times, Ian tries to re-integrate himself (largely unsuccessfully).
Group 5 Gender split in terms of influence and contribution; girls (Fay and Leah) much more in control. Fay dominates resources. Group slow to start; no leader emerges initially. Boys try to get involved; largely ignored by the girls who are confident to change/remove the boys' contributions. The boys lose interest and consider going off task, but L (high C) stops this immediately. Assif's language is very tentative—no direct assertions, often repeats the girls' statements. Contrast with Leah's language which is largely imperative and often the negative. Boys' body language is passive; reluctant to move into the girls' space near the castle.
Group 6 Group dominated by Anna who takes control of resources from the outset (picks up ruler, empties out bucket of blocks). Anna (low A) shuts down others' suggestions; appears unconcerned about upsetting, or contradicting others. Takes resources from others; no negotiation or compromise. Anna's utterances often begin with the word 'no'. She occasionally tries to get others more involved, but this is done through very direct, imperative utterances. There is a lot of talking over each other. Lamiz (focus child) is very quiet and can't compete with Anna. She finds it hard to find a role for herself in all the talk.

both. Pre-existing context, e.g. friendships and known or presumed capabilities, seemed to influence group dynamics in this episode and others (Groups 3, 5 and 6, see Table 3 below).

Non-vignette heterogeneous group qualitative data summaries

Vignette 3: Groups 7 and 8 (homogeneous)—quantitative data

To explore the impact of group composition on PP and IF rankings, FPs were grouped together in homogeneous settings (Groups 7 and 8) to perform similar non-cognitive tasks, albeit with variations. Results are detailed in Tables 1 and 2. Group 7's task involved using blocks to build a bridge supporting a toy car travelling between two points. Group 8 used blocks to construct a castle within an imaginary moat, complete with two small bridges spanning the moat.

A striking finding from the homogeneous groups was more equitable participation compared with the heterogeneous groups, with notably low IF scores in both. In Group 7,

participation levels among the four pupils were very similar. For instance, Laura had contrasting experiences in her homogeneous (Group 4) and heterogeneous (Group 7) episodes. While her total incoming utterances were lower in the homogeneous setting, her PP rate was higher and IF considerably lower (25% vs. more than 50%). Pupils were not asked about their experiences, but it might be reasonable to suggest that being ignored much less and directly addressed more often might feel like a more inclusive and participatory experience and may explain her higher PP rate.

Except for Leah (Group 7), pupils in homogeneous groups were ignored less than in their heterogeneous groups. Leah's seemingly high IF score stemmed from only four utterances to the 'ether', one of which was ignored. Group 8 pupils were notably ignored very little. This could be attributed to several factors: all three girls in Group 8 were identified by their teacher as low in extraversion and high in neuroticism. Lamiz's high extraversion self-report contrasted with her lower participation in Group 6, suggesting that her teacher's assessment was more accurate. Group 8 had fewer utterances directed to the 'ether' (compared with Groups 1–6), but most received responses. In a 9 min episode, only one utterance to the 'ether' failed to elicit a response.

All pupils brought a classroom history to each filmed episode, having known each other for years and previously collaborated on or observed each other's work. It is therefore unrealistic to assume that they did not enter these episodes without preconceived notions of how they might interact in a collaborative setting. In Groups 7 and 8, FPs probably knew from prior experiences that their peers shared similar personalities, potentially reducing potential dominance and increasing receptiveness to each other's suggestions. Regardless, the data indicate that homogeneous groups foster more equitable participation and fewer ignored utterances.

Group 8, being smaller with three pupils instead of four or five, may have experienced fewer utterances lost in the interactions. In larger groups, an utterance to the 'ether' could be assumed to target one of the other specific members and therefore individuals may expect someone else to respond. This assumption is less likely in groups of three (and impossible in groups of two). However, Group 1, also comprising three pupils, maintained high IF scores.

Vignette 2: Groups 7 and 8 (homogeneous)—qualitative data

While the quantitative data suggest that PP was more equally distributed in Group 7, this was only partially borne out by the qualitative analysis. Group 7 consisted of three girls (Leah, Karina and Laura) and one boy (Ian). Ian struggled to focus on the task and was frequently distracted. His utterances were rarely task focused, and he spent a large part of the episode not contributing to the task:

> Look at this, look at this … (Pretends to hit the camera.)

The others attempted to bring him back to the task often addressing him by name:

Laura: Ian, you build this bit.
Leah: Ian, focus, focus!
Leah: Ian, help me work on this side.

Interestingly, Ian's contributions were ignored less in the homogeneous than the heterogeneous episode. Unlike in episode 3 (Table 3), where his peers were content to let him remain off-task for periods, his episode 7 (homogeneous) peers were more intent on

encouraging him back to the task, hence his high PP ranking. He elicited the attention of his peers, although rarely in service of the shared goal.

Among the three girls, PP was largely equitable. Instances of being ignored were rare. All three were actively engaged in the task throughout the episode. Laura (whose self-reported conscientiousness score was low and who was frequently off-task in her heterogeneous group where she was frequently ignored) was much more task focused, less prone to distraction and seemingly more invested in the outcome when in the homogeneous group. These utterances were typical:

> We need to build one like this. (Shows the other two something she has already built.)
>
> We need something longer than this one. So close, so close, we just need one more. (Excitedly trying out the length of the bridge.)

This inclusive, first-person plural language was typical of the interactions between the three girls and was indicative of the equality of participation and high levels of cooperation. The relatively high agreeableness self-reports of all three girls in Group 8 (Karina, 13; Leah, 12; Lamiz, 10) along with their low extraversion scores (Karina, 6; Leah, 7; Lamiz, 13* teacher assessed low E) may help account for the inclusivity of the language and the task.

There were no resources disputes during episodes 7 and 8. The equality of participation was mirrored by a sharing and cooperation with respect to resources, with no member attempting to dominate. At one instance, Laura voluntarily dismantled something that she had been working on to provide materials for another part of the bridge as the group had worked out that there would not be enough bricks to complete the task.

Similarly for Group 8, the quantitative data paint a slightly distorted picture of the equality of PP. In this group, there was a very clear split between Leah and Karina on the one hand, who immediately collaborated to build the bridge, and Lamiz, who was assigned (by Leah and Karina) to build the castle. This division was mirrored in the language used: Karina and Leah using first-person plural language with each other (reinforcing their position as a unit) and second person language when speaking to Lamiz:

Leah (to Lamiz): We'll build the bridge (indicating herself and Karina), you build the castle.
Lamiz (back to Leah): Someone's got to help me with the castle.

So, while Lamiz was highly participatory in terms of being involved in the task (castle construction), she was often working alone (reflected in her low PP ranking).

Despite this, Lamiz's experience in a homogeneous group contrasted with that from her earlier participation in a heterogeneous group. She was never verbally ignored, became more involved, including engaging in some mutual humour:

Karina: I don't know why we have to build him this bridge.
Lamiz: Yeah. Why can't he just swim.
Leah: Difficult, as he's on his horse.

She also made comments indicating growing confidence, which are responded to by the others:

Lamiz: That's a nice castle I built.
Leah: Yeah. It is.

The low IF scores (Karina, 20%; Leah, 0%; Lamiz, 0%) may be reflective of the very high levels of agreeableness (Karina, 10; Leah, 10; Lamiz, 10) and conscientiousness of all three members of the group.

This group, composed entirely of girls reporting low extraversion (and high conscientiousness) scores was, as may have been expected, often quietly focused:

Leah: I'll try starting over here.
Karina: And I'll build the two others. We could have a target, I'll build one and you build one.
Leah: Yeah, I'll do that.

Many of the interactions were task focused and centred around solving practical problems with group members offering suggestions, building on others' ideas and finding solutions. The homogeneity of the participants' personalities (not only in terms of their extraversion and neuroticism scores) may have, at least in part, accounted for this. Characteristic of both homogeneous episodes was a notable lack of disagreement and counterpoint between ideas. On the one hand this resulted in more cooperative group processes; however it also meant that ideas and suggestions were rarely challenged, possibly leading to workable, but not necessarily optimal, outcomes.

FINDINGS AND DISCUSSION

While we emphasise the fact that this was a small-scale pilot study, several potentially important findings have been gleaned from our examination of the data and are summarised below.

Openness and agreeableness of other (non-FP) group members is a possible mediator of participation for FPs. There is some evidence that openness and/or agreeableness can produce blocking and imperative language. Therefore, in groups with members high in extraversion but low in openness and/or agreeableness FPs may be vulnerable to low participation. This is an example of 'exclusion' on Riordan et al.'s (2024) ungrouping model, whereby FPs struggle to participate fully owing to a lack of openness from peers. This was also evident in the distribution of resources and use of physical space. Where these were dominated and FPs lost out, the dominating individuals reported high extraversion and low agreeableness (e.g. Groups 2 and 6). In the homogeneous groups, resources and physical space were not dominated by any single child.

High PP levels are achieved in different ways by different pupils. Those reporting high extraversion and low openness achieved this by 'bossing others around' (imperative language). Those reporting low extraversion but high openness, conscientiousness and agreeableness provoked interactions from their peers by making procedural suggestions. This was evident in two of the three episodes in which the FP was ranked highest for PP (Groups 2 and 5), and in both cases despite their 'shyness' profiles.

Overall, the homogeneous groups appeared to be more congenial environments and more conducive to equal participation of FPs than the heterogeneous groups. Pupils ignored one another far less in the homogeneous than the heterogeneous groupings. The homogeneity of Groups 7 and 8 may help to explain these low IFs, as in addition to all having been identified by the teacher as low in extroversion, all participants self-reported high levels of conscientiousness and agreeableness (and reasonably high levels of openness). A constellation of personality traits which is responsive to others' suggestions and averse to conflict (high openness, high agreeableness) combined with a desire to complete the task successfully (high conscientiousness) could provide a welcoming psychological environment

in which low extraversion pupils feel able to contribute knowing that they are unlikely to be ignored.

When FPs collaborated (i.e. in homogeneous groups), the distribution of interaction and PP was more equitable. Cooperation levels were higher than in the heterogeneous episodes and competition/clashes non-existent, with some pupils sacrificing things they had spent time building to make resources available to implement others' ideas. Homogeneous tasks were also completed more quickly. Littleton and Mercer (2013) suggest that 'exploratory talk' (the most productive form of classroom talk) is typified by equality of participation and by the task-focused discussion that accompanies it. It could therefore be argued that the equality of participation noted in the homogeneous groups is a feature of and enables more productive group work. However, the notable absence of disagreement may also have undermined the emergence of exploratory talk.

Pupils reporting low extraversion may prefer making practical rather than verbal contributions. The homogeneous groups, quieter than the heterogeneous ones, were arguably more efficient in task completion. If less extraverted pupils (and those high in conscientiousness) participate more comfortably in practical tasks, teachers might consider the task nature when forming small groups based on personality. Tasks like art projects, which are practical but less cognitively demanding, may benefit from more heterogeneous group compositions, accommodating participation through action. In contrast, tasks like solving maths problems, requiring extensive discussion, might better suit homogeneous group compositions, allowing less extraverted pupils more space to contribute and therefore learn (Webb et al., 2014).

Stangor (2017) argues that group processes strongly determine group outcomes and that maximum simultaneous effort is a pre-requisite to positive outcomes. In essence, Stangor is arguing for the value of equal participation, evidence for which was patchy in the present study. Equality of participation, both verbally and practically, might enhance 'positive interdependence' (Johnson & Johnson, 2002), or be symptomatic of a group that has embraced it. Groups characterised by asymmetrical participation may be less likely to adopt the idea that the good of the group rests on the understanding of all group members. Our data suggests that homogeneous personality grouping may support the fostering of positive interdependence and the learning gains that are associated with it (Webb, 2009). Johnson and Johnson (2002) make several suggestions about ways in which positive interdependence might be promoted. However, their suggestions do not address the personality traits of group members or recommend that grouping shy learners together might lead to greater equality of participation and therefore greater positive interdependence.

The amount of ignoring was notably lower in the homogeneous groups. Group members being ignored is a feature of Littleton and Mercer's (2013) disputational talk and is not conducive to Johnson and Johnson's (2002) positive interdependence. The fact that all pupils' IF was low in the homogeneous groups suggests that teachers might be able to foster more of what Littleton and Mercer call exploratory talk (learners being ignored less) in collaborative group situations by making selective use of personality homogeneity in group composition.

Appreciating that pupil participation will never be entirely equal, and neither should teachers expect this (Tiberius, 1999), there is evidence to suggest that unequal participation in collaborative learning situations has an adverse effect on learning. Slavin (2010), for example, argues that when the goal of group work is for pupils to 'do' something, equal participation might be less important, but when the goal is to 'learn' something, equal participation becomes more important. Learners' satisfaction levels may also be compromised by unequal participation (Strauß & Rummel, 2021). The undesirable phenomenon of 'social loafing' (the tendency for some individuals to work less hard when in a group; Webb, 2009) may be partly attributable to some learners' tentative contributions being ignored (Kerr &

Bruun, 1983). Our data suggest that openness among group members may correspond to more evenly distributed participation. By adopting personality-sensitive approaches, including strategic distribution of pupils high in openness, teachers may equalise participation in small group collaborations and increase all pupils' satisfaction levels.

LIMITATIONS

Given that this was a small-scale pilot study, we acknowledge several limitations. The study was conducted with a small number of children ($N = 24$) from a single class in a single school in England. There is no sense in which this particular class can be considered typical. While we are not able to make wide, generalisable recommendations, we contend that these tentative claims to knowledge are sufficient to merit further research. Additionally, the FFM data were based on self-reports from the children. As we have acknowledged, there is a possibility that the children may have reported their desired response (or what they perceived to be a desired response) rather than an accurate representation of the way they would have acted in each situation presented in the questionnaire. Some FPs' interactive behaviours matched their FFM trait profiles precisely and others did not. To some extent, limitations in self-report data may explain these discrepancies; however, the complexities of friendships and pre-existing social dynamics could also be mediating factors. Personality data were corroborated by the assessment of the children's teacher to increase confidence when identifying the FPs; however, we remain aware of the limitations of self-report data. In future studies, we would seek to widen the triangulation of personality data points by collecting insights from parents/carers. Data collection for the present study took place on a single occasion and therefore we were not able to explore changes in PP over time, or in different circumstances.

While our use of MMSNA sought to provide a detailed understanding of the interactions of each group, it remains difficult to isolate the effects of personality from those of other factors (i.e. pre-existing friendships) that may also have significantly affected the nature and structure of group interactions. In future studies of this kind, we would seek to explore existing friendship networks before composing groups to minimise their potentially confounding effects.

CONCLUSIONS

This study sought to trial the use of MMSNA to explore the effects of all five FFM personality factors on the nature and pattern of interactions between primary school pupils (aged 9–10). Of particular interest were the implications of these interactions for pupils identified as low in extraversion and high in neuroticism, as they engaged with their peers in collaborative learning situations. The findings suggest that MMSNA is potentially a highly useful tool for exploring group learning in primary schools, that provocation of peer interaction is a useful metric for conceptualising participation and that personality plays a notable role in determining interactions and comparative participation. Below we address each research question. In each case, pedagogical recommendations (RQ 3) follow PP findings (RQs 1 and 2).

In terms of RQ 1, our analysis of the group interactions suggests that pupils we anticipated might be at risk of marginalisation owing to self-reported low levels of extraversion and (in most cases also high levels of neuroticism, FPs) were sometimes, but certainly not always, on the margins of the groups (not central to the group discussions). Some FPs were highly central to their group, often employing collaborative (first person plural) language and making suggestions, sometimes despite being initially rebuffed. This suggests that teachers

seeking to employ personality-sensitive pedagogies might consider providing pupils low in extraversion and/or high in neuroticism with linguistic support to help them to engage with other group members and integrate more fully into the group (RQ 3).

In terms of RQ 2, the data suggest that the personality traits of other group members (particularly those low in openness and agreeableness) influence the ability (and willingness) of FPs to integrate into collaborative groups. Teachers keen to use personality-sensitive pedagogies may benefit from working with pupils whose personality traits might prevent others from participating to make them more receptive to others' views and to temper their natural propensity to dominate, even at the expense of the learning of their fellow pupils (RQ 3).

A key finding was the fact that when FPs were grouped together, their experiences of collaborative group work changed. They were ignored much less and the groups they were in exhibited much more equitable participation. This suggests that personality profiles of FPs' peers play a role in the equality of participation (RQs 1 and 2). The talk in such groups more closely resembled 'collaborative talk' (Littleton & Mercer, 2013). Teachers seeking to facilitate more equal patterns of contribution in collaborative situations might consider taking personality factors into account and, sometimes at least and for certain types of tasks, grouping shy pupils together (RQ 3).

This pilot study has introduced the novel concepts of PP and IF, as lenses through which to analyse group influence and interaction. It represents an interesting and potentially fruitful line of inquiry, suggesting that more research into the role of personality in collaborative learning situations, using a MMSNA methodology and our novel concept of PP, is needed to further enhance suggestions for practical, personality-sensitive pedagogies.

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ORCID
Marcus Witt https://orcid.org/0000-0001-6795-7083
Ben Knight https://orcid.org/0000-0003-1476-4231

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