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Finnish and Estonian teachers' views on the nature of intelligence

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The purpose of this study was to investigate Finnish (n = 226) and Estonian (n = 347) teachers' views on the nature of intelligence. The study utilized a survey that included a qualitative, open-ended question about teachers' definition of intelligence and the quantitative inventory Implicit Theories of Intelligence (ITI). We then employed a convergent mixed-method design to understand teachers' views on the nature of intelligence. These views were divided into four main categories: the multidimensional nature of intelligence, manifestational nature of intelligence, developmental nature of intelligence, and creative nature of intelligence. Teachers from both countries highlighted cognitive features, such as memory, information processing, and problem-solving skills, as a part of the multidimensional nature of intelligence. In addition, teachers viewed intelligence as developmental when measured with the ITI inventory, indicating that intelligence is considered incremental. Lastly, when triangulating the qualitative and quantitative data of teachers' views on the nature of intelligence, only one statistically significant difference was found. Teachers with an entity view of intelligence also mentioned entity features in their own descriptions. The results showed that teachers views' on the nature of intelligence are rather broad; however, in future studies, teacher interviews and classroom observation might provide even more profound understanding of teachers' views on this topic.

KEYWORDS

teacher, intelligence, mindset, convergent mixed-method design, Finland, Estonia

Introduction

This study is a part of larger research project investigating teachers' professional ethics in Finland and Estonia. Previous studies related to this project have focused on teachers' ethical sensitivity (Ronkainen et al., 2021), purposeful teaching (Ronkainen et al., 2022), and teachers' growth mindset in the classroom (Ronkainen et al., 2019). This study continues the comparison of Finnish and Estonian teachers with the convergent mixed-method design (Creswell, 2015). In this manuscript, we explore Finnish and

Estonian teachers' views on the nature of intelligence. These views influence teachers' pedagogical thinking and practices (e.g., Schmidt et al., 2015; Patterson et al., 2016; Rissanen et al., 2018; Ronkainen et al., 2019; Zhang et al., 2020; Yu et al., 2022) and have implications for teacher ethics (Tirri and Kuusisto, 2022). Moreover, teachers' views on the nature of intelligence can contribute to students' academic achievements (e.g., Jones et al., 2012; Jonsson et al., 2012; Rau, 2016).

The teachers in this study come from countries whose educational systems are highly respected and whose students' academic achievements are ranked high in international comparative studies (Organisation for Economic Cooperation and Development [OECD], 2018a,b; Gouëdard, 2021). Both countries feature similar education systems, which consist of pre-school, basic education (grade 1–9), general upper-secondary school or vocational education, and higher education. Teachers are university educated to the master's degree level, and their teaching is guided by the national curriculum (Estonian Government, 2011; Finnish National Board of Education, 2016). In both countries, national curricula emphasize students' holistic education and wellbeing (Estonian Government, 2011; Tirri, 2011; Finnish National Board of Education, 2016), and educational policy is guided by the notion of equal opportunities and high-quality education for all (Tirri, 2014; Ministry of Education and Research, n.d.). Moreover, in contrast to many other countries, assessments and testing do not play a primary role in either Finland or Estonia, which is also in line with a holistic view of education.

At the beginning of the 20th century, the situation in Finland and Estonia was rather similar, as both countries began to develop as independent nation states and introduced compulsory educational systems. However, in Estonia, the post-WWII period witnessed the Russification of education (Soviet period) and the introduction of a totalitarian system that influenced schooling for over 40 years. During this time, Finland began to build its welfare state, and education was decentralized in 1980. Estonia, in turn, regained its independence in 1991.

Perspectives on intelligence

Historically, intelligence research has emphasized the measurement of IQ, short for Intelligence Quotient. The first standardized test to assess intelligence, the *Binet-Simon Scale*, was already created a century ago by the psychologist Alfred Binet (Hally, 2015). Shortly afterward, the psychologist Lewis Terman modified Binet's IQ test and named it the *Stanford-Binet Intelligence Scale* (Hally, 2015). Today, this scale is widely used throughout the world (e.g., Boake, 2002; Hally, 2015), including in Finland and Estonia. IQ tests were created to measure attention, memory, and problem solving (Boake, 2002; Hally, 2015). Proponents of IQ tests tend to view intelligence as an innate, inherent, fixed quality which remains stable throughout a person's life span (see also Räty et al., 1993). Nevertheless, although IQ tests are broadly used to measure intelligence, they are far from uncontroversial. For instance, as Shuttleworth-Edwards (2016) notes, the fundamental assumption underlying IQ testing is that a person's true level of intellectual ability is measurable and reflected in IQ test scores. The concept of IQ is rather narrow and may not represent the full capacity and diversity of intelligence. For instance, according to Gardner and Moran (2006), IQ tests fail to measure real-world success; rather, in the context of school, they primarily evaluate linguistic and logical-mathematical intelligence.

More lately, the cultural and social aspects of intelligence have also been acknowledged. For example, Sternberg (2014) considers intelligence to be related to a person's ability to interact with the environment in which they live. According to Mugny and Carugati (1989), intelligence is a cultural creation that, while central to modern society, varies according to historical period, geographical location, and social circumstances. Similarly, Snellman and Räty (1995) define conceptions of intelligence as social representations. Gardner, in turn, Gardner (2000) defines intelligence as "a biopsychological potential to process information that can be activated in a cultural setting to solve problems or create products that are of value in a culture" (pp. 33–34). He continues by stating that intelligences are a set of abilities, talents, or mental skills that can also be termed human cognitive competence (Gardner, 2006, p. 6).

Gardner's theory of multiple intelligences (MI), first introduced in 1983, is a combination of empirical findings that encompass cognitive and developmental psychology, neuroscience, anthropology, and cultural studies. In his book *Frames of Mind*, Gardner (1983) identified seven intelligences which are identifiable in most cultures: linguistic intelligence, logical-mathematical intelligence, musical intelligence, spatial intelligence, bodily-kinesthetic intelligence, interpersonal intelligence, and intrapersonal intelligence. Linguistic–and logical- mathematical intelligence constitute the traditional and more deeply examined conception of intelligence that is typically also valued in schools and measured with IQ-tests. By contrast, musical-, spatial-, and bodily-kinesthetic intelligence are usually viewed as abilities that are less intellectual and more arts- or sports related. In turn, interpersonal intelligence concerns an individual's ability to understand other people and interact fluently with them, whereas intrapersonal intelligence is the capacity to understand oneself, including knowledge of one's own capabilities and reactions (Gardner, 1983, 2000, 2006; Gardner and Hatch, 1989; Gardner and Moran, 2006). Later, Gardner (2000, 2006) added naturalistic intelligence and existential intelligence as new domains. Naturalistic intelligence refers, for example, to the capacity to connect experience to elements of the natural world. In turn, existential intelligence concerns what is also described

as the "intelligence of big questions." Gardner objected to the term "spiritual intelligence" because its complexity and spirituality are largely based on human experiences, which are not a valid indicator of intelligence (Gardner, 2006). In Finland, Tirri and Nokelainen (2011) have developed a self-assessment instrument to measure multiple intelligences in educational contexts, and they suggest that naturalistic intelligence might be close to environmental sensitivity, whereas existential intelligence can be viewed as spiritual sensitivity.

Although MI theory considers the social and cultural aspects of intelligence, its efficacy and validity have also been questioned (Attwood, 2022). According to Shearer (2004), it is crucially important to note that MI is a new kind of construct based on a unique definition of intelligence. In addition, Rousseau (2021) defends and discusses the validity of Gardner's MI theory's by emphasizing its original aim: to expand the traditional, narrow IQ concept of intelligence. According to Attwood (2022), the debate surrounding MI theory is linked to semantics, as the concept of intelligence seems to be used synonymously with the concept of preferences. Another debate concerns the accusation that MI theory is a neuromyth, a misconception about the brain and learning based on a "kernel of truth" (Grospietsch and Mayer, 2018). Nevertheless, despite the criticism of MI theory's efficacy and validity, and its specific definition of intelligence, MI theory offers qualitative value in the context of teacher education and teaching. MI theory provides an entry point for a discussion of differentiation and may play a relevant role in personalized learning and assessment (Attwood, 2022).

Gardner's theory and other current definitions of intelligence highlight the developmental nature of intelligence [e.g., Dweck, 2000; Gardner, 2000; see also studies on giftedness (Reis and Renzulli, 2009; Gagné, 2010; Subotnik et al., 2011; Laine and Tirri, 2021)]. Teachers' beliefs, which are also called implicit theories, implicit beliefs, or mindsets about the nature of intelligence, indicate whether they are more inclined to view intelligence or other human qualities, such as abilities and personality, as malleable and incremental or fixed and entity based (Dweck, 2000, 2006). Previous studies have demonstrated that implicit beliefs influence teachers' behavior and thus students' learning (see, e.g., Kraker-Pauw et al., 2017). Even though mindsets have been found to be relatively stable, they are still alterable, and even brief interventions have exerted a long-lasting influence on students' motivation and school achievements (Blackwell et al., 2007; Yeager et al., 2019). According to Dweck (2000), an individual can possess an incremental view on intelligence, a so-called growth mindset, i.e., the notion that intelligence can be developed, or an entity view, also known as a fixed mindset, which refers to the belief that intelligence is innate and fixed. People with an incremental view of intelligence highlight the importance of effort in academic performance, whereas people holding an entity view of intelligence emphasize that academic performance is mainly determined by innate ability: they believe that individuals possess a certain amount of intelligence that cannot be changed (Dweck and Leggett, 1988; Dweck, 2000). A vital difference between people holding an incremental or entity view of intelligence is how they encounter difficulties. Those who adhere to an incremental view of intelligence consider failures opportunities to learn, whereas those holding an entity view of intelligence see failures as mistakes (Dweck, 2000). In addition, a growth mindset or incremental view of intelligence resonates with definitions of resilience and grit (Yeager and Dweck, 2012), which involve, for example, seeking new strategies to facilitate learning, solving conflicts peacefully, or learning from constructive feedback. According to previous studies, teachers' incremental views on intelligence tend to predict better motivation and achievement among their students, since teachers adhering to an incremental theory of intelligence use more effective teaching practices than do teachers with an entity theory of intelligence or a fixed mindset (Rogers, 2009; Rattan et al., 2012; Seaton, 2018). For instance, a study by Yeager et al. (2022) demonstrated that teachers' and students' growth mindset not only created a more supportive classroom environment but also enhanced students' academic performance. In addition, a study by Nalipay et al. (2022) showed that teachers who hold a growth mindset or an incremental view of intelligence about their teaching ability enjoyed better well-being. This finding indicates the wide scope of a growth mindset in teachers' thinking, behavior, and even holistic well-being. Moreover, a meta-analysis conducted by Sarrasin et al. (2018) indicated that inducing a growth mindset by teaching neuroplasticity led to an overall positive effect on motivation, achievement, and brain activity.

Studies in the U.S. and a wide range of other countries have shown that most teachers hold an incremental view of intelligence (Claro et al., 2021). Additionally, previous studies from Finland and Estonia demonstrate that the majority of teachers, students, and parents adhere to an incremental view of intelligence (Kuusisto et al., 2017; Aus et al., 2019; Zhang et al., 2020; Toivanen, 2022). However, empirical studies suggest that a self-rated incremental view of intelligence is not always manifested in actual teaching and learning (Aus et al., 2019; Rissanen et al., 2021). Rather, subjects may claim to hold a growth mindset simply because it is more socially desirable than a fixed mindset (Trzesniewski et al., 2021). In such situations, the mindset can be manifested as a "false growth mindset" (Aus et al., 2019; Rissanen et al., 2021). Furthermore, Kärkkäinen and Räty (2010) have shown that while Finnish teachers typically exhibit a growth mindset toward low academic achievers—i.e., these students possess the potential to develop in their academic studies—they nevertheless display an entity-view mindset toward high academic achievers (see also Patterson et al., 2016; Rissanen et al., 2019), indicating the domain specificity of intelligence mindsets.

This study aims to answer the research question "How do Finnish and Estonian teachers view the nature of intelligence?" In our analysis, we utilize Gardner's (1983, 2006) MI theory to describe the multidimensional nature of intelligence and Dweck's (2000) theory to describe its developmental character. This research design allowed us to employ a mixed-methods approach.

Materials and methods

Procedure

In this study, the data were gathered from teachers in Finland (n = 226) and Estonia (n = 347) during fall 2019 and spring 2020. In Finland, it was necessary to seek permission for the research first from the municipalities where the schools were located and then from school principals and teachers. By contrast, in Estonia, permission for the research was sought directly from principals and teachers. In both countries, this permission process followed the guidelines for ethical review in human sciences (Finnish national board on research integrity TENK, 2019). Thus, the research plan contained a report on the ethical issues raised by the research. Ninety-one schools from 11 municipalities in Finland and 48 schools from seven municipalities in Estonia participated in the research, and the teachers' involvement was voluntary. Finnish and Estonian principals were contacted by email to enquire about their interest in participating in the research and forwarding the survey to their teachers. This online survey, which was created with Qualtrics-software, began with background questions on topics such as the participants' age, gender, school level at which they taught, taught subject(s), and teaching experience (presented below). It then progressed to questions on teachers' professional ethics, such as ethical sensitivity and purpose in life (not reported in this study), and questions concerning teachers' views on the nature of intelligence and their beliefs about its malleability.

Participants

Table 1 presents the participants' background characteristics. The average participant in both countries was a female teacher approximately 48 years of age with around 19 years of teaching experience. Our sample included class teachers, subject teachers (languages, mathematics, history, religion, art, etc.), and special education teachers.

TABLE 1 Finnish and Estonian teachers' background information.

	Finland n = 226	Estonia n = 347	Total N = 573
Gender			
Female	169 (74 %)	314 (90 %)	483 (84 %)
Male	56 (25 %)	33 (10 %)	89 (16 %)
Other	1 (0,4 %)		1 (0,2 %)
Educational level			
Class teacher	79 (35 %)	67 (19 %)	146 (25 %)
Subject teacher	93 (41 %)	222 (64 %)	315 (55 %)
Special education teacher	54 (24 %)	58 (17 %)	112 (20 %)
Age	M = 47 (SD = 10.7) Min 26, Max 72	M = 49 (SD = 12.8) Min 22, Max 80	M = 48 (SD = 12.0) Min 22, Max 80
Teaching experience	M = 16 (SD = 10.0) Min 0, Max 40	M = 21 (SD = 14.0) Min 0, Max 56	M = 19 (SD = 12.8) Min 0, Max 56

Instruments

This study utilizes a convergent mixed-method design (Creswell, 2015) to research teachers' views on the nature of intelligence and their beliefs about its malleability. The survey included several instruments and open-ended questions, of which, in this study, we first analyze the answers to an open-ended question asking teachers to describe their definition of intelligence: "We all have our own definitions of what intelligence is. Write your own definition of intelligence in the box below."

Secondly, we used Dweck's (2000) Implicit Theories of Intelligence (ITI) inventory to measure the participants' incremental vs. fixed views on the nature of intelligence. The ITI includes four statements that were rated on a Likert-type scale (1 = completely disagree, 6 = completely agree). Lower scores indicated a tendency toward a growth mindset (Dweck, 2000). The items are presented in **Table 2**. The instrument has been validated in earlier research (Dweck, 2000) and later studies in Finland (Kuusisto et al., 2017) and Estonia (Aus et al., 2019). The internal reliability of the scale was analyzed using Cronbach's alpha ($\alpha_{Finnish}$ = 0.935; $\alpha_{Estonia}$ = 0.940), which indicated a high level of internal consistency in both countries.

Analysis

Qualitative analysis

The written statements were analyzed using qualitative content analysis in a deductive manner, as proposed by Elo and Kyngäs (2008). More specifically, to study the multidimensional nature of intelligence, we applied Gardner's (1983, 2006) theory of multiple intelligences, while the developmental nature of intelligence was investigated with Dweck's (2000) theory. To describe our data better, we merged Gardner's logical-mathematical and linguistic intelligence domains into the subcategory the *cognitive nature of intelligence*, and musical, visual arts, kinesthetic, and spatial into the *artistic nature of intelligence*. We also identified two other aspects in teachers' definitions, which we named inductively the "manifestational" and "creative" nature of intelligence. Finally, teachers' views

TABLE 2 Items of implicit theories of intelligence (ITI).

	Finland $n = 224$	Estonia $n = 347$
	M (SD)	M (SD)
Implicit theories of intelligence	**2.43 (1.049)**	**2.55 (1.101)**
1. You have a certain amount of intelligence, and you really cannot do much to change it.	2.28 (1.119)	2.65 (1.218)
2. Your intelligence is something about you that you cannot change very much.	2.51 (1.100)	2.52 (1.191)
3. To be honest, you cannot really change how intelligent you are.	2.33 (1.139)	2.41 (1.140)
4. You can learn new things, but you cannot really change your basic intelligence.	2.58 (1.225)	2.62 (1.239)

Scale 1.0–6.0; lower scores indicate an incremental view of intelligence.

on the nature of intelligence were divided into four main categories and 10 subcategories. The main categories were the multidimensional nature of intelligence, manifestational nature of intelligence, developmental nature of intelligence, and creative nature of intelligence (see Table 3).

The following examples of answers to the open-ended question show the diversity of teachers' understanding of the nature of intelligence:

> "*There are many types of intelligence:* social, logical reasoning, mathematical, musical, ethical, etc. Intelligence is not just one characteristic but is made up of several components. Intelligence is not an innate quality, but something we can develop" (Finnish class teacher, female, ID 17)

> "Intelligence is partly innate and partly an environmental phenomenon" (Finnish class teacher, male, ID 416)

> "Intelligence is a mental capacity that includes the ability to reason logically, to plan, to solve problems, to think abstractly, to understand concepts and language, and to learn" (Estonian class teacher, female, ID 64)

> "In my opinion, emotional intelligence is when a person is able to control his or her feelings, is empathetic and considerate toward other people. Intelligence is not always just academic wisdom that can be learned through knowledge; in my opinion, *what matters is how to put theoretical knowledge into practice*" (Estonian language and subject teacher, female, ID 239)

The unit of analysis was a word, words, or sentences indicating one single aspect of the nature of intelligence. In these examples presented above, we identified several units of analysis: the multidimensional (the underlined and bolded text above: cognitive, interpersonal, existential, artistic features), developmental or entity (bolded text: malleable or fixed features), and manifestational (italics: other, and skill and ability features) nature of intelligence. A codebook was developed to specify and note the rules of analysis. All units of analysis were coded in Excel, which also enabled us to calculate the frequencies. To ensure interrater reliability for the coding, kappa values were calculated both for the subcategories formed from the developmental and multidimensional main categories and also for 10–20% of the data from the manifestational and creative main categories. Based on discussions between the researchers, minor changes were made to the codebook to improve mutual understanding of the rules of the analysis. The kappa values varied between 0.653 and 1.00, indicating substantial and almost perfect agreement between the coders, in alignment with the thinking of McHugh (2012). After all kappa values had reached a substantial level of agreement or higher ($\kappa > 0.60$), the first author analyzed the remaining data according to mutual understanding of the rules of analysis.

Quantitative analysis

IBM SPSS Statistics 24 was utilized to inspect the descriptive statistics of the ITI-scale, with a t-test used to compare the Finnish and Estonian teachers' scores. In addition, crosstabulation and Chi-square tests were computed to analyze whether the Finnish and Estonian teachers differed in their written descriptions and to triangulate the qualitative and quantitative results to determine whether conceptualizations of intelligence differed among teachers with growth-mindset and fixed-mindset tendencies as measured with the ITI-scale. In the crosstabulations, we inspected the standardized residuals, of which a score over | 2| is considered, according to MacDonald and Gardner (2000), to be an indicator of a statistically significant difference.

TABLE 3 Teachers' views on the nature of intelligence in the qualitative data.

Nature of intelligence	Finland		Estonia		Finland		Estonia		Crosstabulations[a] Chi-square tests	Standardized residuals > |2|
	f	%	f	%	n[a]	%	n	f%		
Multidimensional	**506**	**72**	**742**	**80**	**184**	**81**	**284**	**82**	$\chi^2(1) = 0.017$	–
Cognitive features	280	40	290	30	151	67	175	50	$\chi^2(1) = 14.976^{***}$	Finnish 2.0
Interpersonal features	118	17	193	20	100	44	165	48	$\chi^2(1) = 0.601$	–
Intrapersonal features	67	10	179	19	56	25	137	40	$\chi^2(1) = 13.244^{***}$	Finnish –2.3
Existential features	22	3	44	5	21	9	41	12	$\chi^2(1) = 0.903$	–
Naturalistic features	10	1	34	4	10	4	34	10	$\chi^2(1) = 5.574^{*}$	–
Artistic features	9	1	2	0	9	4	2	1	$\chi^2(1) = 8.432^{**}$	Finnish 2.2
Manifestational	**81**	**12**	**100**	**11**	**69**	**31**	**93**	**27**	$\chi^2(1) = 1.005$	–
Skill and ability features	42	6	95	10	40	18	89	26	$\chi^2(1) = 4.958^{*}$	–
Other features	39	6	5	1	39	17	5	1	$\chi^2(1) = 48.551^{**}$	Finnish 5.2, Estonian –4.2
Developmental	**84**	**12**	**89**	**9**	**64**	**28**	**74**	**21**	$\chi^2(1) = 3.661$	–
Incremental features	72	10	76	8	59	26	67	19	$\chi^2(1) = 3.687$	–
Entity features	12	2	13	1	12	5	13	4	$\chi^2(1) = 0.802$	–
Creative	**30**	**4**	**21**	**2**	**29**	**13**	**21**	**6**	$\chi^2(1) = 7.899^{**}$	Finnish 2.1
Total	701		952		226		347	–	–	–

Bold values refer to four main categories on the nature of intelligence. f, frequencies of unit of analysis; n, number of teachers. $^{***}p < 0.001$, $^{**}p < 0.01$, and $^{*}p < 0.05$. [a]We cross tabulated and Chi-square tested the number of teachers in each category with their nationality.

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Results

Teachers views on the nature of intelligence in their written definitions

Teachers' views on the nature of intelligence were divided into four main categories: multidimensional, manifestational, developmental, and creative (see **Table 3**). We identified a total of 1,653 units of analysis, of which 701 (42%) were found in the Finnish teachers' definitions and 952 (58%) in those of the Estonian teachers.

Multidimensional nature of intelligence

The multidimensional nature of intelligence (f = 1248, 75%) was the largest main category in both countries ($f_{Finnish}$ = 506, 72%; $f_{Estonian}$ = 742, 80%). Moreover, cognitive features (f = 570, 34%) was the largest subcategory among both Finnish (40%) and Estonian (30%) teachers. Cognitive features referred to memory and information processing (f = 253), logical-mathematical intelligence (f = 213), problem-solving skills (f = 104), and linguistic intelligence (f = 16). The cognitive features of intelligence were described, for example, as "an ability to think critically and from multiple perspectives" (Finnish special education teacher, female, ID 665) and "the ability to think, analyze and draw adequate conclusions" (Estonian science and art teacher, female, ID 164).

Interpersonal features (f = 311, 19%) formed the second largest subcategory, referring to social-emotional intelligence (f = 260) and compassion for others (f = 51). Here, some teachers used this precise wording for the concepts (e.g., Finnish language teacher, female, ID 423), whereas other teachers' descriptions were more illustrative: "For me, the most important is emotional intelligence—the ability to communicate pleasantly with others and to understand others" (Estonian language teacher, female, ID 267.)

The intrapersonal features of intelligence (f = 246, 15%) referred to personal characteristics (f = 100), self-knowledge (f = 75), and perseverance (f = 70). These personal characteristics included flexibility ($f_{Finnish}$ = 6, $f_{Estonian}$ = 32), humility and modesty ($f_{Finnish}$ = 1, $f_{Estonian}$ = 32), gratitude ($f_{Finnish}$ = 3, $f_{Estonian}$ = 12), and accountability ($f_{Finnish}$ = 3, $f_{Estonian}$ = 11). Such personal characteristics were particularly highlighted by Estonian teachers, among whom this form of intelligence was often viewed, for example, as "modesty" (Estonian class teacher, female, ID 371), and the "ability to be flexible" (Estonian physics teacher, female, ID 260). In turn, the intrapersonal feature of self-knowledge was described by one respondent as follows: "An intelligent person can self-reflect" (Finnish class teacher, female, ID 22). Perseverance referred to an intelligent person's "ability to cope with situations" (Estonian art teacher, female, ID 125). Estonian teachers (19%) emphasized intrapersonal features almost twice as much as did their Finnish counterparts (10%).

The subcategory existential features (f = 66, 4%) represented wisdom (f = 41) and ethics and spirituality (f = 25). Wisdom was viewed, somewhat paradoxically, as both part of intelligence and separate from it, as the following example illustrates: "An intelligent person has the wisdom of life in addition to intelligence" (Finnish home economics teacher, female, ID 420). By contrast, ethical values and spirituality were simply seen as a component of intelligence and mentioned briefly: "Intelligence is ethical" (Finnish class teacher, female, ID 17); "[intelligence involves] spirituality" (Estonian subject teacher, female, ID 543).

Naturalistic features (f = 44, 3%) represented the second smallest subcategory. These features indicated a person's ability to understand society, nature, and animals. For instance, one teacher stated that an intelligent person possessed "the ability to function as a part of [the]environment" (Finnish special education teacher, female, ID 7), while another remarked that intelligence was "understanding the events of the world and history and understanding why everything really repeats itself in nature, history, and culture" (Estonian history teacher, female, ID 382). The smallest subcategory in the multidimensional nature of intelligence was artistic features (f = 11, 1%), which primarily referred to musical ability but also included kinesthetic and visual arts. Existential, naturalistic, and artistic features accounted for less than eight percent of all codes. Nonetheless, although these subcategories were small, they underline that the entire spectrum of Gardner's theory of multiple intelligence (Gardner, 1983, 2006) was present in the teachers' descriptions. Crosstabulations and Chi-square tests showed (see **Table 3**) that Finnish teachers were more likely to emphasize cognitive and artistic features and less likely to stress intrapersonal features (standardized residuals for Finnish teachers 2.0, 2.2, and −2.3, respectively) than were their Estonian counterparts.

Manifestational nature of intelligence

The manifestational nature of intelligence (f = 181, 11%) was the second largest main category in both countries ($f_{Finnish}$ = 81, 12%; $f_{Estonian}$ = 100, 11%). This main category included two subcategories: skill and ability features (f = 137, 8%), and other features (f = 44, 3%). Skill and ability features ($f_{Finnish}$ = 42, $f_{Estonian}$ = 95) referred to a skill or ability or their application in different domains. For example, some teachers described intelligence as "a skill" (Finnish language teacher, female, ID 435), whereas others stated that an intelligent person "can apply them [new things] to learning and practice" (Finnish religion teacher, male, ID 2). The teachers also mentioned how intelligence could be manifested through earlier experience, expertise, and success

in life as "life experience" (Finnish class teacher, male, ID 428) or "thriving" (Estonian art teacher, female, ID 557). The second subcategory, other features, referred to units of analysis where intelligence was manifested in multiple domains, reflected in the statement "there are many types of intelligence" (Finnish class teacher, female, ID 17), or as general intelligence, i.e., that a person is generally intelligent in every repect or possesses a broad and comprehensive intelligence: "Intelligence manifests itself in the human being as a whole" (Estonian mathematics teacher, female, ID 493). The Finnish teachers (n = 39, 17%, standardized residual 5.2) more frequently mentioned explicit words referring to the general or domain specific nature of intelligence [$\chi^2(1) = 48.551$, $p < 0.01$] than did their Estonian peers (n = 5, 1%, standardized residual −4.2).

Developmental nature of intelligence

The developmental nature of intelligence (f = 173, 10%) was divided into two subcategories: incremental features (f = 148, 9%) and entity features (f = 25, 2%). Incremental features indicate that intelligence can be developed and learned, that it is the outcome of practice, and that an intelligent person learns from mistakes. The incrementality of intelligence was described as "the ability to learn new things throughout life" (Finnish math teacher, female, ID 647), "a characteristic that is constantly evolving" (Estonian language teacher, female, ID 270) or as "learning from mistakes" (Finnish class teacher, female, ID 455).

By contrast, entity features refer to the innate, unalterable quality of intelligence, as in the following example: "For some, it is an inherent characteristic" (Finnish language teacher, female, ID 435). Less than two percent of the Finnish and Estonian teachers in our study mentioned features representing entity views. Additionally, however, some teachers understood intelligence as containing both incremental and entity features: "Intelligence is something that is innate, but it can be developed" (Estonian physical education teacher, female, ID 518); "We have different potential for intelligence that is activated/deactivated by the environment" (Finnish religion teacher, male, ID 637); "Intelligence can be innate or acquired through education" (Estonian language teacher, female, ID 271). In both countries developmental features were emphasized more than entity features.

Creative nature of intelligence

The creative nature of intelligence (f = 51, 3%) was the smallest main category in both countries (f_{Finnish} = 30, 4%; f_{Estonian} = 21, 2%). This category generally indicated innovativeness and the ability to produce new things. The creative nature of intelligence was also manifested as openness and curiosity toward learning, life, and the unfamiliar, as illustrated by the following statement: "Curiosity about the world lays the foundation for intelligence" (Finnish religion teacher, other, ID 344). Even though the creative nature of intelligence was the smallest main category, Finnish teachers (n = 29, 13%, standardized residual 2.1) mentioned creative features more often [$\chi^2(1) = 7.899$, $p < 0.01$] than did their Estonian counterparts (n = 21, 6%).

Teachers' views on the nature of intelligence based on their Dweck's inventory scores

The mean scores in Dweck's inventory showed that the majority of Finnish and Estonian teachers (M_{Finnish} = 2.43, SD = 1.049; M_{Estonian} = 2.55, SD = 1.101) supported a malleable view of intelligence, i.e., a growth mindset (**Table 2**). Moreover, no statistically significant differences were found between Finnish and Estonian teachers' mindsets [$t(569) = -1.258$, $p > 0.05$, $d = -0.116$].

Next, we triangulated the qualitative and quantitative data to determine whether teachers' views on the nature of intelligence as measured with Dweck's inventory were related to their written descriptions. Hence, teachers were grouped based on their scores in Dweck's instrument as advised by Rissanen et al. (2019). Teachers whose mean scores were between 1.0 and 3.0 were coded as possessing a growth mindset (GM, n = 432, 75%; n_{Finnish} = 181, 80%; n_{Estonia} = 251, 72%), while those with a score from 4.0 to 6.0 were coded as exhibiting a fixed mindset (FM, n = 76, 13%; n_{Finnish} = 28, 12%; n_{Estonia} = 48, 14%). In turn, means between 3.1 and 3.9 were considered to reflect a mixed mindset (n = 63, 11%; n_{Finnish} = 15, 7%; n_{Estonia} = 48, 14%); however, we utilized only GM and FM groups for the crosstabulations, in line with Claro et al.'s (2016) example. Two Finnish teachers failed to complete the ITI-scale, and thus they were excluded from further analysis. Overall, the number of teachers placed in the GM and FM groups indicates that a growth mindset was the most prevalent approach in both countries (Finnish teachers 80%; Estonian teachers 72%), while only around 10 percent of teachers (Finnish teachers 12%; Estonian teachers 14%) displayed fixed-mindset tendencies, these results are also in line with earlier research (see, e.g., Kuusisto et al., 2017; Aus et al., 2019; Claro et al., 2021).

The GM and FM groups were cross tabulated with the categories identified in the written descriptions, but no statistically significant differences were found between the GM and FM teachers' qualitative answers within either Finland or Estonia. However, when the countries were combined, one statistically significant difference [$\chi^2(1) = 10.059$, $p < 0.01$] emerged: the FM teachers' ($n_{\text{Finnish\&Estonia}}$ = 9, 12%, standardized residual = 2.9)

own definitions contained more *entity features* than did the GM teachers' responses ($n_{\text{Finnish\&Estonia}}$ = 15, 4%), a result that aligns with the theoretical perspectives discussed earlier.

Discussion

The purpose of this study was to investigate Finnish (n = 226) and Estonian (n = 347) teachers' views on the nature of intelligence. We adopted a convergent mixed-method design and used both qualitative and quantitative data. Teachers from both countries answered a survey with an open question in which they described intelligence in their own words. In addition, they rated Dweck's (2000) inventory items, which measure implicit theories of intelligence. Our inductive content analysis was guided by Gardner's (1983, 2006) theory of multiple intelligences regarding the cultural aspects of intelligence and Dweck's (2000) theory in respect to developmental views of intelligence. In addition, inductive content analysis was employed to investigate those aspects of the teachers' answers that did not fit Gardner's or Dweck's theories.

The first main finding was that Finnish and Estonian teachers defined intelligence in similar ways. Their answers were divided into four main categories of intelligence: multidimensional, manifestational, developmental, and creative. In both countries, teachers emphasized the multidimensional nature of intelligence, which reflected the majority of Gardner's domains (Gardner, 1983, 2006). The most typical descriptions included cognitive features, such as memory, information processing, and problem-solving skills. The participants also described intelligence as logical-mathematical ability. These are just the qualities that are measured in IQ tests, and thus teachers still seem to view intelligence in a similar way to the IQ tradition. Here, a notable finding was that Finnish teachers displayed a stronger tendency to provide cognitive descriptions of intelligence than did their Estonian counterparts. This is somewhat surprising, since earlier studies in Estonia have demonstrated a narrower understanding of intelligence among Estonian teachers. For example, a study by Saul et al. (2007) found that school leaders considered academic performance the most important factor when assessing talent, while research by Laul (2018), revealed that teachers viewed learning outcomes and grades as the most important indicator of students' skills.

By contrast, the Estonian teachers in this study were more likely than their Finnish peers to emphasize the importance of intrapersonal features in the multidimensional nature of intelligence. This indicates that, for Estonian teachers, an intelligent person possesses self-awareness that is manifested in good manners and humility. This difference might reflect historical developments in the two countries. For instance, Estonia's period within the Soviet Union, where humility was emphasized and autonomy was limited, may have influenced our participants' views (Krull and Trasberg, 2006). In Finland, teachers are autonomous professionals who enjoy a great deal of freedom in their work (Tirri, 2014). This sense of freedom and autonomy could explain why they were more likely than their Estonian counterparts to highlight artistic features and the creative nature of intelligence. A study by Erss et al. (2016) on Finnish and Estonian teachers' perceptions of curricular autonomy showed that Finnish teachers felt they had more influence over the choice of content than did Estonian educators. Overall, our data on teachers from both countries support Gardner's (1983, 2006) view of naturalistic and existential intelligence as possible domains. Research by Tirri and Nokelainen (2011) also found similar domains, which they termed environmental and spiritual sensitivity.

The second main finding was that teachers from both countries tended to rate their views of intelligence as developmental when measured with Dweck's (2000) inventory. However, this tendency was not equally strong in their own descriptions of intelligence, indicating a possible "false growth mindset" (Dweck, 2015; Aus et al., 2019). Thus, Dweck's quantitative mindset instrument might provide overly positive ratings that fail reflect actual thinking and behavior (Dweck, 2000). Therefore, further research could investigate how teachers' views on the nature of intelligence are manifested in concrete teaching activities.

The third main finding was that, when we divided teachers into growth-mindset and fixed-mindset groups based on their self-rated scores in Dweck's inventory, no within-country differences were found between the groups in their descriptions of intelligence. However, one statistically significant and theoretically meaningful difference was found when the datasets were combined: fixed mindset teachers' descriptions included entity features. This tentatively indicates that Dweck's (2000) inventory provides more accurate results for fixed mindsets than for growth mindsets.

This study offered new insights into Finnish and Estonian teachers' views on the nature of intelligence and a comparative perspective on teachers from two countries. To our knowledge, no similar comparison has been performed in previous research. Nonetheless, our participants' qualitative descriptions were rather short, and a deeper understanding of teachers' views on the nature of intelligence could be gained with interviews and observations. Future interview-based studies on teachers' perceptions of intelligence could offer broader and more

in-depth understanding of the nature of intelligence (what intelligence is, how it is manifested, and why teachers perceive it in a certain way). In this study, teachers wrote their own definition of intelligence, but they were not guided to clarify their views with further questions. Thus far, we know from previous research and the present study that teachers seem to associate intelligence with IQ and the domains of Gardner's (1983, 2006) MI theory (e.g., Rousseau, 2021; Makkonen et al., 2022). Interviews and classroom observations could offer a broader understanding of phenomenon. As Sternberg (2014) notes, the nature of intelligence is diverse, which increases the importance of researching it in multiple ways.

In addition, our research design allowed the collection of large datasets from both Finland and Estonia, and thus the results can be generalized to the wider population of teachers in both countries. The results of this study show that even today teachers understand intelligence mostly as a cognitive quality, which resembles the views reflected by IQ tests. Thus, our findings indicate that teachers from both countries require in-service education in order to understand intelligence as multidimensional and developmental in nature. One might assume that educators who have recently graduated from teacher education exhibit more incremental beliefs about intelligence, as teacher training programs already include the latest research on intelligence; however, this hypothesis also requires further investigation.

Data availability statement

The raw data supporting the conclusions of this article will be made available by the corresponding author upon request.

Ethics statement

This study followed the ethical guidelines of the Finnish National Board on Research Integrity and Estonian Code of Conduct for Research Integrity. The participants provided their written informed consent to participate in this study.

Author contributions

RR collected the data. RR and EK administered the qualitative and quantitative analysis. All authors developed the research project, contributed to the article, and approved the submitted version.

Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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