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Identification of multiple intelligences with the Multiple Intelligence Profiling Questionnaire III

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Abstract

In this study, we present the latest version of the Multiple Intelligences Profiling Questionnaire (MIPQ III) that is based on Howard Gardner's (e.g., 1983, 1999) MI theory. The operationalization of nine MI scales is tested with an empirical sample of Finnish preadolescents and adults (n = 410). Results of the internal consistency analysis show that the nine MIPQ III dimensions have satisfactory reliability coefficients with the sample. Results of the inter-scale correlation analysis show that (1) Logical-mathematical intelligence correlates positively with Spatial intelligence; (2) Linguistic intelligence correlates positively with Intrapersonal intelligence; (3) Linguistic and Intrapersonal scales correlate positively with the Spiritual and Environmental intelligences. Results of the correlation analysis between the gender, age and the MI scales show that (1) Males in both samples have higher self-rated Logical-mathematical intelligence than females; (2) Females rate their linguistic abilities higher than the males. The results of CFA show good generalizability characteristics of the MIPQ III scales. Our findings give important information to teachers and educators on how gender influences the self-perception of students' abilities.

Key words: MI theory, MIPQ, psychometrics, survey, gender

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Introduction

Earlier studies on gender differences among gifted students indicate that males outperform females in mathematics and science (Reis, 1998, pp. 187-214). According to Reis, the main reason that some girls do not succeed in mathematics is not any lack of ability or effort; it's simply that girls are not expected to succeed in these areas. A great deal of stereotyping and prejudice affects girls and boys in their studies. According to Siegle and Reis (1998) adolescent female gifted girls indicated that they had higher ability than males in language arts only, while male gifted students indicated they had higher ability than females in mathematics, science, and social studies. Eccles' research (1984) has demonstrated that even when girls and boys were both earning the highest grades in mathematics and English, girls were considered by their parents to be better in English and boys to be better in mathematics. Even when girls had higher grades, higher standardized test scores, and higher teacher ratings in mathematics, parents believed that mathematics was harder for girls than for boys. These gender stereotypes are very universal and similar findings of parental attitudes have been reported with Finnish samples as well (Tirri, 2002). Research results have also shown a positive correlation between perceived ability and achievement (Multon, Brown, & Lent, 1991). Therefore, students' self-perception of their own abilities becomes a key factor in educating high ability students.

Multiple Intelligences Profiling Questionnaire III (MIPQ III, Tirri & Komulainen, 2002; Tirri, Nokelainen & Ubani, 2006; Tirri & Nokelainen, 2007) is a five-point Likert scale self-rating questionnaire that is based on Howard Gardner's Multiple Intelligence (MI) theory (1983, 1991, 1995, 1999, 2000, 2006). MIPQ is aimed to assist both learners in their self-reflection and teachers to understand their student's strengths. First version of the MIPQ (Tirri, K., Komulainen, Nokelainen & Tirri, H., 2002, 2003) operationalized the seven MI dimensions with 28 items: (1) Linguistic, (2) Logical-mathematical, (3) Musical, (4) Spatial, (5) Bodily-kinesthetic, (6) Interpersonal and (7) Intrapersonal intelligence. Eighth dimension, spiritual intelligence, was added to the second, 32-item version of the MIPQ (Tirri, Nokelainen & Ubani, 2006). Spiritual intelligence dimension is based on Spiritual Sensitivity Scale (SSS) influenced by Hay's (1998) and Bradford's (1995) definitions of spirituality. Ninth dimension, environmental intelligence, was added to the present, 35-item version of the instrument, MIPQ III (Tirri & Nokelainen, 2007). Environmental intelligence dimension is based on Environmental Sensitivity Scale (EnSS) influenced by the work of Gardner (1999), Morris (2004) and Wilson (1998).

Sternberg (1991) identifies Gardner's MI theory as a systems approach similar to his own triarchic theory (1985). Although he likes Gardner's assessments at a theoretical level, he believes them to be a psychometric nightmare (Sternberg, 1991). The biggest challenge for the advocates of Gardner's approach is to demonstrate the psychometric soundness of their instrument. Sternberg is calling for hard data that would show that the theory works operationally in a way that will satisfy scientists as well as teachers.

Major goals of this paper are, firstly, to present the third version of the Multiple Intelligences Profiling Questionnaire (MIPQ III) that contains the ninth dimension, Environmental Intelligence (EnI), and secondly, to test the psychometric properties of the MIPQ III with an empirical sample.

This paper is organized as follows: First, we present the theoretical structure of the MIPQ III; Second, the psychometric properties of MIPQ III's nine dimensions are tested

with two sub-samples consisting of Finnish preadolescents and adults (n = 410); Finally, we will discuss the results and justify the present study.

Theoretical framework

Gardner's theory of multiple intelligences builds on a concept of an "intelligence", which he defines as "the ability to solve problems, or to create products, that are valued within one or more cultural settings" (Gardner, 1993, p. x). In his latest work Howard Gardner (2006, p. 50) also views the intelligences as "raw, biological potentials, which can be seen in pure form only in individuals who are, in the technical sense, freaks". He lists seven intelligences (IQ) that meet his criteria for intelligence. These intelligences are (1) Linguistic, (2) Logical-mathematical, (3) Musical, (4) Spatial, (5), Bodily-kinesthetic, (6) Interpersonal and (7) Intrapersonal (Gardner, 1983, p. xi). The first version of MIPQ operationalized these seven intelligences and validated their psychometric properties with an empirical sample of Finnish university students (Tirri et al., 2002, 2003).

Tirri and Komulainen (2002) operationalized *Linguistic intelligence* dimension to include both verbal and written expressions. It was assumed that people whose intelligence profile includes a strong linguistic component would give themselves high ratings on learning and entertaining themselves with words and verbal games. The factor scores weights revealed that linguistic intelligence consists of two different components. The first one, *"*Academic verbalness", measured self-perception on verbal learning ("Metaphors and vivid verbal expressions help me learn efficiently" and "At school studies in native language or social studies were easier for me than mathematics, physics and chemistry"). The other component of linguistic intelligence consisted of items that measured "Everyday verbalness*"*. The highest loading variables included the following items "I am good at entertaining myself and others with wordplay and jokes" and "It is easy for me to play with word games, for example crossword puzzles"). The reliability of the scale was reasonable (α = .64).

Logical-mathematical intelligence consisted of items that measured both persons' perceptions on their mathematical ability and on logical thinking skills (Tirri & Komulainen, 2002). This intelligence had two components as well. The highest loading items, "At school I was good at mathematics, physics or chemistry", "Mental arithmetic is easy for me", and "I am good at games and problem-solving which require logical thinking", measured problem solving in academic contexts. The component was named *"*Academic problem-solving*"*. The other component, *"*Systematic and logical thinking", included items that measured analytical, logical and systematic thinking in general. The highest loading variables included the following items: "I tend to look for consistency, models and logical series in things", "I can easily measure, classify, analyze or calculate things", "I want to present things as logically as possible and give reasons for them" and "I easily notice lapses of logic in other people's everyday speech or actions". The reliability of the scale was good (Alpha .76). (Tirri & Komulainen, 2002; Tirri et al., 2002, 2003.)

According to Tirri and her colleagues (2002, 2003), *Musical intelligence* was the most reliable and homogeneous of all the Gardnerian scales (Alpha .93). The ten items of the scale measured musical ability of hearing and producing music. The highest loading variables were the items "When listening to music, I am able to discern instruments or recognize melodies" and "I notice immediately if a melody is out of tune".

Spatial intelligence measured persons' views on his/her abilities to visualize and work with multidimensional objects. This intelligence consisted of two components. One of them dealt with visual imaging and the other with spatial perception. The highest factor score weights on the component measuring visual imaging included the following items: "When I think, I can see clear visual images in my mind", "I am able to see objects or events that I would like to document on camera or video", and "I'm good at drawing and designing various kinds of figures". The highest factor score weights measuring spatial perception included the items: "It is easy for me to conceptualize complex and multidimensional patterns", "I can easily imagine how a landscape looks from a bird's-eye view", and "At school, geometry and various kinds of assignments involving spatial perception were easier for me than solving equations". The reliability of the scale was good (α = .73). (Tirri & Komulainen, 2002.)

Bodily-kinesthetic intelligence was operationalized to include items measuring persons' views on their abilities related to working with hands and coordinating their bodies. This scale consisted of two components, as well. The "Handyman*"* component included the following items: "I am handy", "I was good at handicrafts at school", and "I can easily do something concrete with my hands (e.g. knitting and woodwork). The other component was named "Body coordination*"*, because it included items related to coordination skills. The following items had high scores in this component: "I am very good at tasks that require good coordination" and "I have good coordination". The reliability of the scale was good (α = .74). (Tirri & Komulainen, 2002.)

Interpersonal intelligence was the second most homogeneous of the Gardnerian scales (Alpha .82). The items measured persons' perceptions of his/her abilities to social relations. The highest factor weights were on the items "I make contact easily with other people" and "I get along easily with different types of people". (Tirri & Komulainen, 2002.)

Intrapersonal intelligence consisted of two components. The *"*Self-reflection" component measured persons' views on their ability to reflect on important issues in life and deep psychological and philosophical issues. The highest scoring factor weights were on items "I spend time regularly reflecting on the important issues in life", "I like to read psychological or philosophical literature to increase my self-knowledge", and "I keep a diary or note down happenings of my inner life". The other component "Self-knowledge*"*, dealt with issues concerning individuals' ability to analyze themselves and the courage to express their own opinions. The highest scoring items were, "I am able to analyze my own motives and ways of action", "I have opinions of my own and dare to disagree with others", and "I can handle the emotions caused by serious setbacks". The reliability of the scale was good (α = .70). (Tirri & Komulainen, 2002.)

Gardner bases his MI theory upon neurological, evolutionary, and cross-cultural evidence (Gardner, 1983, p. xii). In the first edition of his MI theory, over twenty years ago, Gardner adopted a very individualistic point of view in exploring various intelligences (Gardner, 1983). In his newest edition of the MI theory, Gardner emphasizes more cultural and contextual factors in the development of seven intelligences (Gardner, 1999). Gardner has retained the original seven intelligences presented earlier, but he acknowledges the possibility of adding new intelligences to the list. He has worked on naturalistic, spiritual and existential intelligences to be included in his list of multiple intelligences.

The second version, MIPQ II, included *Spiritual intelligence* as its eighth dimension. The Spiritual sensitivity scale consists of the following four dimensions: (1) Awareness sensing,

(2) Mystery sensing, (3) Value sensing and (4) Community sensing (Tirri, Nokelainen & Ubani, 2006). Hay (1998) has identified three categories of spiritual sensitivity. "Awareness sensing" refers to an experience of a deeper level of consciousness when we choose to be aware by "paying attention" to what is happening. This category coincides with Gardner's (1999) notion of "spiritual as achievement of a state of being". According to Hay (1998, p. 60) this kind of awareness refers to a reflexive process of being attentive towards one's attention or "being aware of one's awareness". The second category of spiritual sensitivity, "mystery sensing", is connected to our capacity to transcend the everyday experience and to use imagination. For instance, the beauty and wonder of sunrise and sunset includes the sense of mystery even after the scientific explanations are presented. Imagination is essential to religious activity through the metaphors, symbols, stories and liturgies, which respond to the otherwise unrepresentable experience of the sacred. This category relates to both Gardner's (1999) understanding of spiritual intelligence as the "achievement of a state of being" and the "concern with cosmic or existential issues", while emphasizes the mysterious nature of such experiences. The third category, "value sensing", emphasizes the importance of feelings as a measure of what we value. Among such things are the issues that touch our existential questions and meaning seeking. (Hay, 1998, p. 70-74.) This category resembles with Gardner's (1999) definition of spiritual intelligence as the "concern with cosmic or existential issues". Tirri and her colleagues added a social dimension to Hay's three categories of spiritual sensitivity (Tirri et al., 2006). The social aspect of spirituality has been suggested also by Gardner (1999). The fourth sub scale of spiritual sensitivity is called "community sensing" and is based on the work of Bradford (1995). Bradford has identified three types of spirituality. *Human spirituality* refers to the needs of care, love, security and responsibility we all desire. *Devotional spirituality* is built upon this human spirituality and it is expressed within a certain religious tradition, culture and language. The third type of spirituality is *practical spirituality* in which both other types of spiritualities merge. Practical spirituality is shown in our everyday lives giving us the direction and influencing our social responsibilities and concerns (Bradford, 1995). Bradford's definitions represent the social aspect in the domains of spiritual intelligence (Gardner, 1999) and include the practical problem solving applications suggested by Zohar and Marshall (2000) and Emmons (2000). Tirri et al. (2006) conducted a series of empirical studies to validate the eighth intelligence dimension of the MIPQ II.

The present version, MIPQ III, includes *Environmental intelligence* as its ninth dimension. The dimension has following three categories: 1) Love for nature; 2) Nature conservation; 3) Environment-friendly consumer habits. First category, "Love for nature", aims to capture our appreciation of being in the nature, even just like sitting quietly and noticing the subtle differences in the world of nature, and making observations about natural changes, interconnections and patterns (Wilson, 1998). It is operationalized with the item "I enjoy the beauty and experiences related to nature." Second category, "Protection of animal rights and nature", aims to capture our love for the animals and passion to know and remember things about them. This category is operationalized with the item "Protecting the nature is important to me." Third category, "Environment friendly consumption", aims to capture our talent for ecological sensibility, that is, understanding the fact that "human beings and all the other creatures are interconnected within a complex ecosphere" (Morris, 2004, p. 164). Third category is operationalized with the items "I pay attention to my

consumption habits in order to protect environment". The construct validation process of the ninth dimension is described in detail in Tirri and Nokelainen (2007).

In this paper, we present the final version of the Multiple Intelligences Profiling Questionnaire (MIPQ III) and test its psychometric properties with an empirical sample of Finnish preadolescents and adults (n = 410).

Method

Sample

The non-probability sample was collected with the 35-item MIPQ III in 2002-2003. The theoretical structure of the questionnaire was analyzed with a sample (n = 410) that consists of Finnish preadolescents (n = 183) and (3) adults (n = 227). The youngest respondents were 183 Finnish elementary school 5th and 6th grade students. One hundred and four (56 %) were girls and 79 (44 %) were boys. Their age median was 12 years. The second group represents Finnish adults consisting of peace keepers (n = 195 with 194 males and 1 female) and youth leaders (n = 32 with 6 males and 23 females, 3 missing). Their age median was 51 years. The age information of peace keepers is not included in the data.

Multiple Intelligence Profile Instrument III (MIPQ III)

The MIPQ III measures nine dimensions of Gardner's MI theory: (1) Linguistic, (2) Logical-mathematical, (3) Musical, (4) Spatial, (5) Bodily-kinesthetic, (6) Interpersonal, (7) Intrapersonal, (8) Spiritual, and (9) Environmental intelligence. The instrument consists of 35 items on a Likert-scale from 1 (*totally disagree*) to 5 (*totally agree*). The psychometric properties of the dimensions are validated in our earlier studies (Tirri & Komulainen, 2002; Tirri, K., Komulainen, Nokelainen & Tirri, H., 2002, 2003; Tirri, Nokelainen & Ubani, 2006; Tirri & Nokelainen, 2007). The total number of items has been reduced from 95 to 35 items (Table 1).

Procedure

The sample was collected with a non-probability sampling. Each respondent was personally invited to complete a paper and pencil version of the questionnaire. The children, adolescents and adults answered the questions with the same wordings. Participants were asked to use the Likert-scale from 1 (*totally disagree*) to 5 (*totally agree*) to evaluate their attitude towards the statements measuring multiple intelligences and environmental sensitivity.

Total population in Finland is 5.2 million. The country consists of five culturally and economically equal provinces: 1) Lapland (N = 187,777, 4 %), 2) Oulu (N = 457,345, 9 %), 3) Western Finland (N = 1,843,225, 35 %), 4) Eastern Finland (N = 584,974, 11 %) and 5) Southern Finland (N = 2,106,117, 41 %). The preadolescent sample (n = 183) was collected from two provinces, Western and Southern Finland in 2002-2003. The adult sample (n = 227) represented all the provinces and was collected in 2003.

Table 1:
Linguistic, Logical-mathematical, Musical, Spatial, Bodily-kinesthetic, Interpersonal, Intrapersonal, Spiritual and Environmental Intelligence Items in the MIPQ III

Item	*Label*	**Preadolescents (*n* = 183)** $\bar{x}$ (*s*)	**Adults (*n* = 227)** $\bar{x}$ (*s*)
lingu_1	Writing is a natural way for me to express myself.	3.36 (0.96)	2.72 (1.15)
lingu_2	At school studies in native language or social studies were easier for me than mathematics, physics and chemistry.	3.10 (1.23)	3.21 (1.19)
lingu_3	I have recently written something that I am especially proud of, or for which I have received recognition.	2.93 (1.29)	2.00 (1.21)
lingu_4	Metaphors and vivid verbal expressions help me learn efficiently.	3.25 (0.94)	3.52 (1.01)
logic_1	At school I was good at mathematics, physics or chemistry.	2.71 (1.33)	2.72 (1.13)
logic_2	I can work with and solve complex problems.	3.08 (1.18)	3.54 (0.89)
logic_3	Mental arithmetic is easy for me.	3.79 (1.07)	3.51 (1.01)
logic_4	I am good at games and problem solving, which require logical thinking.	3.43 (1.19)	3.41 (0.94)
spati_1	At school, geometry and various kinds of assignments involving spatial perception were easier for me than solving equations.	2.88 (1.13)	2.98 (1.24)
spati_2	It is easy for me to conceptualize complex and multidimensional patterns.	3.28 (0.98)	3.45 (0.86)
spati_3	I can easily imagine how a landscape looks from a bird's-eye view.	3.50 (1.04)	3.35 (1.00)
spati_4	When I read, I form illustrative pictures or designs in my mind.	3.78 (1.06)	3.52 (1.08)
bodki_1	I am handy.	3.49 (0.96)	3.92 (0.93)
bodki_2	I can easily do something concrete with my hands (e.g. knitting and woodwork).	3.99 (1.04)	4.03 (1.04)
bodki_3	I am good at showing how to do something in practice.	3.28 (0.89)	3.88 (0.77)
bodki_4	I was good at handicrafts at school.	3.90 (1.14)	4.04 (1.00)
music_1	After hearing a tune once or twice I am able to sing or whistle it quite accurately.	3.28 (1.23)	2.92 (1.32)
music_2	When listening to music, I am able to discern instruments or recognize melodies.	3.34 (1.15)	3.29 (1.35)
music_3	I can easily keep the rhythm when drumming a melody.	3.29 (1.06)	3.20 (1.28)
music_4	I notice immediately if a melody is out of tune.	3.16 (1.19)	3.08 (1.29)

continued

Item	*Label*	**Preadolescents (*n* = 183)** $\bar{x}$ (*s*)	**Adults (*n* = 227)** $\bar{x}$ (*s*)
inter_1	Even in strange company, I easily find someone to talk to.	3.30 (1.14)	3.84 (0.89)
inter_2	I get alone easily with different types of people.	3.58 (1.01)	4.26 (0.75)
inter_3	I make contact easily with other people.	3.30 (0.98)	3.84 (0.77)
inter_4	In negotiations and group work, I am able to support the group to find a consensus.	3.26 (0.85)	3.72 (0.74)
intra_1	I am able to analyze my own motives and ways of action.	3.25 (0.83)	3.86 (0.77)
intra_2	I often think about my own feelings and sentiments and seek reasons for them.	3.39 (1.10)	3.43 (1.08)
intra_3	I spend time regularly reflecting on the important issues in life.	3.01 (1.20)	2.88 (1.12)
intra_4	I like to read psychological or philosophical literature to increase my self-knowledge.	2.23 (1.11)	2.33 (1.15)
sp1_1	In midst of busy everyday life I find it important to contemplate.	3.13 (1.07)	3.50 (1.15)
sp2_18	Even ordinary every-day life is full of miraculous things.	3.91 (1.07)	3.76 (0.99)
sp3_3	I often reflect on the meaning of life.	3.17 (1.23)	3.13 (1.16)
sp4_16	It is important to me to share a quiet moment with others.	2.41 (1.02)	2.29 (1.08)
en1_36	I enjoy the beauty and experiences related to nature.	3.98 (1.08)	4.37 (.80)
en3_33	Protecting the nature is important to me.	2.81 (1.12)	2.20 (1.06)
en4_23	I pay attention to my consumption habits in order to protect environment.	2.59 (1.08)	2.73 (1.14)

Statistical analyses

Statistical analyses were conducted in four phases. *First*, internal consistency of the MIPQ III was tested with Cronbach's alpha (1970). In this study, we consider alpha levels of the reliability analysis against Nunnally's (1978, pp. 245-246) statement: "increasing reliabilities much beyond .80 is often wasteful of time and funds with the exception of applied settings where important decisions are made with respect to specific test scores." *Second*, correlations between the nine MIPQ III scales were analyzed with Spearman rho. *Third*, correlations between the nine MIPQ III scales and the background variables (age, gender) were analyzed with Spearman rho. The fixed level of type-I-error was determined in advance to be $\alpha = .05$ in both second and third phases of the analyses. Kubinger, Rasch & Simeckova (2007) suggest that when testing a correlation coefficient's significance it is preferable to use H_0: $0 < \rho < \lambda$ instead of H_0: $\rho = 0$. In this study, we set the $\lambda = .3$. Further, according to Kubinger and his colleagues (id.), the magnitude of the dependency between two random variables can be interpreted by using the coefficient of determination (r^2), which

represents "the percentage of the variance of one of two random variables which can be explained by a linear regression on the other variable" (id., p. 76). *Fourth*, the external validity of the nine MI scales was initially studied with confirmatory factor analysis for categorical indicators.

Results

Phase 1: Reliability Analysis of the MIPQ III

The first phase of the analysis investigates psychometric properties of the 35-item MIPQ III. Table 2 presents the factor structure and alpha loadings for the nine MI scales. The results were in parallel with the findings of our previous studies (Tirri & Komulainen, 2002; Tirri, K., Komulainen, Nokelainen & Tirri, H., 2002, 2003; Tirri, Nokelainen & Ubani, 2006): Musical and Interpersonal scales had the highest reliabilities (α = .88 - .89), and Linguistic and Spatial scales had the lowest reliabilities (α = .53 - .62). The reliability estimates for the EnI three-item composite variable ranged from .67 to .79. As discussed earlier, alpha depends on the dimensionality of the scale (one-dimensional vs. multidimensional); higher reliability is achieved with one-dimensional constructs. The second issue affecting reliability is that when the abstraction level of the concept increases, like with the spiritual intelligence, the invention on unambiguous propositions becomes more difficult.

Phase 2: Correlational Analysis of the MIPQ III

The second step in the analysis is to calculate Spearman non-parametric correlations between the nine MI dimensions with the preadolescent (n = 183) and adult (n = 227) samples (Table 3). The results show that Logical-mathematical intelligence is statistically related to the Spatial intelligence in both samples, $r(183) = .48$, $p < .01$, $r^2 = .23$ and $r(227) = .39$, $p < .01$, $r^2 = .15$ as both variables share 23 and 15 per cent mutual variance, respectively. Further, in both samples the Linguistic intelligence is more strongly related to Intrapersonal than Interpersonal intelligence, $r(183) = .49$, $p < .01$, $r^2 = .25$ and $r(227) = .52$, $p < .01$, $r^2 = .27$. However, both aforementioned dimensions correlate positively in both samples, $r(183) = .42$, $p < .01$, $r^2 = .18$ and $r(227) = .36$, $p < .01$, $r^2 = .13$.
In both samples, Linguistic, $r(183) = .48$, $p < .01$, $r^2 = .23$ and $r(227) = .34$, $p < .01$, $r^2 = .12$, and Intrapersonal, $r(183) = .59$, $p < .01$, $r^2 = .35$ and $r(227) = .61$, $p < .01$, $r^2 = .37$, scales are strongly related to the Spiritual scale. We reanalyzed the dependency between intrapersonal and spiritual intelligences by controlling for Linguistic intelligence. The result of partial correlation with preadolescent sample showed that Intrapersonal and Spiritual scales have 22 per cent mutual variance, $r(183) = .47$, $p < .01$. The result of partial correlation with the adult sample showed that Intrapersonal and Spiritual scales have 29 per cent mutual variance, $r(227) = .54$, $p < .01$. Logical-mathematical, Bodily-kinesthetic and Interpersonal scales had the weakest correlations with the Spiritual scale in both samples.

Table 2:
Factor Structure and Alpha Loadings for the MIPQ III

		Preadolescents (*n* = 183)	**Adults (*n* = 227)**
Scale	*Items*	α	α
Linguistic	lingu_1, lingu_2, lingu_3, lingu_4	.62	.59
Logical-mathematical	logic_1, logic_2, logic_3, logic_4	.76	.63
Musical	music_1, music_2, music_3, music_4	.83	.89
Spatial	spati_1, spati_2, spati_3, spati_4	.53	.54
Bodily-kinesthetic	bodki_1, bodki_2, bodki_3, bodki_4	.71	.84
Interpersonal	inter_1, inter_2, inter_3, inter_4	.81	.80
Intrapersonal	intra_1, intra_2, intra_3, intra_4	.72	.76
Spiritual	sp1_1, sp2_18, sp3_3, sp4_16	.70	.76
Environmental	en1_36, en3_33, en4_23	.67	.79

Table 3:
Zero-order Correlations Between the MIPQ III Scales

Scale	1	2	3	4	5	6	7	8	9
	Preadolescents (*n* = 183)								
1. Linguistic	–	.15	.39	.45	.36	.34	.49	.48	.38
2. Logical-mathematical		–	.12	.48	.15	.26	.31	.27	.18
3. Musical			–	.39	.41	.50	.36	.32	.32
4. Spatial				–	.32	.31	.40	.39	.34
5. Bodily-kinesthetic					–	.44	.16	.29	.36
6. Interpersonal						–	.42	.28	.24
7. Intrapersonal							–	.59	.38
8. Spiritual								–	.45
9. Environmental									–
	Adults (*n* = 227)								
1. Linguistic	–	.11	.15	.22	-.03	.28	.52	.34	.32
2. Logical-mathematical		–	.10	.39	.19	.04	.19	.22	.19
3. Musical			–	.27	.11	.24	.16	.26	.14
4. Spatial				–	.28	.21	.31	.20	.26
5. Bodily-kinesthetic					–	.11	-.09	.10	.10
6. Interpersonal						–	.36	.23	.17
7. Intrapersonal							–	.61	.30
8. Spiritual								–	.50
9. Environmental									–

Further, Linguistic, $r(183) = .38$, $p < .01$ and $r(227) = .32$, $p < .01$, Intrapersonal, $r(183) = .38$, $p < .01$ and $r(227) = .30$, $p < .01$ and Spiritual $r(183) = .45$, $p < .01$ and $r(227) = .50$, $p < .01$, scales shared the strongest (and positive) correlations with the environmental intelligence scale. However, as their respective determination coefficients show ($r^2 = .14$, $r^2 = .10$, $r^2 = .14$, $r^2 = .09$), statistical dependencies were quite weak. We reanalyzed the aforementioned dependencies with partial correlation by controlling the gender. These analyses were conducted only with one sub sample, the preadolescents ($n = 183$), as the gender information for the other sample was not available. The results of the partial correlation with preadolescent sample showed that gender had a clear non-direct effect on only one dependency: Correlation between intrapersonal and environmental intelligence decreased from .38 to .21. Logical-mathematical and interpersonal scales had the weakest correlations with the environmental scale in both samples. We found earlier that these two dimensions are not statistically related to the spiritual intelligence (Tirri et al., 2006). We concluded that the weak connection between mathematics and spirituality was related to the fact that spiritual issues are usually not easily addressed with scientific reasoning. Perhaps the same conclusion is valid with environmental issues that are also strongly based on values and beliefs?

Phase 3: Correlations between the background variables and the MIPQ III

The third phase of the analysis investigated correlations between age, gender and the MIPQ scales (Table 4). Unfortunately, age and gender information were present only in the preadolescent sample for all the nine MI scales. Results considering the first seven MI scales showed that boys in the preadolescent sample rated their Logical-mathematical intelligence higher than girls, $r(183) = .39$, $p < .01$, $r^2 = .15$. This result was also weakly present in our earlier study with the university students (Tirri & Komulainen, 2002), $r(256) = .27$, $p < .001$ $r^2 = .07$. Females tended to rate their linguistic abilities higher than the males in both current, $r(183) = -.18$, $p < .01$, $r^2 = .03$ and the past study (Tirri, K., Komulainen, Nokelainen & Tirri, H., 2002), $r(256) = -.49$, $p < .001$. $r^2 = .25$. This result should be interpreted with caution as the mutual variance in the current study between the variables is only three per cent.

Our earlier study (Tirri, K., Komulainen, Nokelainen & Tirri, H., 2002) validated the MI scales with various controlling variables. The results showed that those students who had received good grades in mathematics in their matriculation examination rated their Interpersonal skills to be lower than their colleagues who had received lower grades, $r(256) = -.22$, $p < .001$, $r^2 = .05$. Results also indicated that good grades in mother tongue in the matriculation examination explain students' high ratings in the Linguistic intelligence component, $r(256) = .34$, $p < .001$, $r^2 = .12$.

In addition, our previous study showed weak evidence that Linguistic intelligence seems to increase with age, $r(256) = .22$, $p < .001$, $r^2 = .05$ as the older students rated this component significantly higher than their younger colleagues. Results showed that the females tended to rate themselves higher than the males in both interpersonal, $r(256) = .29$, $p < .001$, $r^2 = .08$, and intrapersonal intelligence, $r(256) = .45$, $p < .001$, $r^2 = .20$. The first finding was repeated in the current study, but with a weak correlation, $r(183) = -.18$, $p < .05$, $r^2 = .03$.

Table 4:
Zero-order Correlations Between Gender, Age and the MIPQ III Scales

	Preadolescents (n = 183)		Adults[a] (n = 32)	
Scale	Gender[b]	Age	Gender[b]	Age
1. Linguistic	-.18	-.04	–	–
2. Logical-mathematical	.39	-.16	–	–
3. Musical	-.15	-.04	–	–
4. Spatial	.16	-.08	–	–
5. Body-kinesthetic	-.14	-.04	–	–
6. Interpersonal	-.18	.08	–	–
7. Intrapersonal	.00	.02	–	–
8. Spiritual	-.04	.06	.30	.19
9. Environmental	-.26	-.08	-.30	-.04

[a]Adult sample contains only youth leaders. [b]Female = 0, Male = 1.

Phase 4: Confirmatory factor analysis

The last phase of the statistical analysis was to evaluate the goodness-of-fit of the MIPQ III model with both preadolescent and adult samples (Table 5). In addition, the model fit to the combined sample was investigated. The RMSEA estimate, as well as the upper bound of 90 per cent confidence interval, were in both samples below the fair fit level of .05 – .08 (Hair, Anderson, Tatham & Black, 1995). Residuals exceeded slightly the cut-off value of .08 in all samples. Incremental fit measures were in both samples below the recommended level of .90 (Tucker & Lewis, 1973). Results of the combined sample (n = 378) also indicated satisfactory generalizability of the model.

Table 5:
Goodness-of-fit Values for the MIPQ III Scale

	Preadolescents (n = 183)	Adults[a] (n = 195)	Combined sample (n = 378)
Measures of Absolute Fit			
χ^2	964.25	998.34	1355.00
df	524	524	524
p	.000	.000	.000
RMSEA	.071	.068	.066
90 per cent C.I.	.064 .078	.062 .075	.062 .071
SRMR	.088	.087	.081
Incremental Fit Measures			
CFI	.772	.817	.807
TLI	.741	.793	.781

Note. RMSEA= Root Mean Square Error of Approximation with 90 percent confidence interval. SRMR = Standardized Root Mean Square Residual. TLI = Tucker-Lewis coefficient. CFI = Comparative Fit Index.
[a]Adult sample contains only Finnish peacekeepers.

We did not do any model modifications during the analysis as, according to Hu and Bentler (1995, p. 99), "… when procedures are used that empirically modify a model to make it look as good as possible in a particular sample, all of the model fit indexes will appear unduly optimistic about the quality of the model." However, we probed the model with two simple procedures. First, we randomly assigned the 35 items to the nine MI dimensions and calculated the fit indices for the combined data (n = 378). Results showed a dramatic change in goodness-of-fit measures. For example, CFI and TLI values dropped to .452 and .358, respectively. This is a theoretically justifiable finding as all the items are allowed to interact with each other and, thus, produce a high overall correlation. Second, we inputted a random data (within the original MIPQ III value range from 1 to 5) into the CFA model. The analysis did not converge at all as the maximum number of iterations (first n = 1000 and then n = 10000) was exceeded.

Conclusions

In this study, we presented the latest version of the Multiple Intelligences Profiling Questionnaire (MIPQ III) that is based on Gardner's (1983, 1991, 1995, 1999, 2000, 2006) MI theory. The operationalization of nine MI scales was tested with an empirical sample of Finnish preadolescents and adults (n = 410): Firstly, internal consistency of the MIPQ III was tested; Secondly, correlations between the nine MIPQ III scales were studied; Thirdly, correlations between the nine MIPQ III scales and the background variables (age, gender) were analyzed; Fourthly, the external validity of the nine MI scales was studied with a confirmatory factor analysis (CFA). Results of the internal consistency analysis showed that the nine MIPQ III dimensions had satisfactory reliability coefficients with both sub samples. The results of CFA showed good generalizability characteristics of the MIPQ III scales. Combined sample (n = 378) did fit to the model better than two sub samples indicating good generalizability of the model.

Results of the MIPQ III inter-scale correlation analysis showed that (1) Logical-mathematical intelligence correlated positively with Spatial intelligence in both samples; (2) Linguistic intelligence correlated positively with Intrapersonal intelligence; (3) Linguistic and Intrapersonal scales correlated positively with the Spiritual and Environmental scales in both samples.

Results of the correlation analysis between the gender, age and MIPQ III scales showed that males in the preadolescent sample rated their Logical-mathematical intelligence higher than females. This finding is in accord with earlier studies concerning gender differences among gifted students. A study by Siegle and Reis (1998) found that adolescent male gifted students indicated they had higher ability than females in mathematics, science, and social studies. Females tended to rate their linguistic abilities higher than the males. The similar results have been reported with our earlier studies using this instrument with gifted preadolescents (Tirri & Ubani, 2007).

Earlier research on gender differences in mathematical achievement has shown that gifted girls tend to underestimate their abilities in this area and this trend could have influenced the self-rated behavior of the girls in our sample as well. Kerr (1994) and Reis (1998) have identified external barriers to gifted women to excel as including the attitudes of parents and school, environmental options and possible discrimination or harassment at

school or at work. The possible internal barriers among gifted females included self-doubt, self-criticism, and too low expectations. According to Siegle and Reis (1998), gifted girls tend to underestimate their abilities, especially in mathematics, social studies and science.

There was no statistically significant difference found in the spiritual sensitivity of the males and females. This contrasts to traditional studies on gender differences on religiousness, which present female participants as more religious and spiritual than male participants (i.e., Tamminen, 1996). Firstly, this tendency can be explained by the nature of items measuring spiritual sensitivity. Majority of the items measured spirituality in conceptual level that is not related to any kind of religious institution (Tirri, Nokelainen & Ubani, 2006). Secondly, in earlier studies on religiosity and spirituality the instruments have measured belief in God and religious rituals like praying or going to the church (Tamminen, 1991). Thirdly, this study showed a positive correlation between environmental attitudes and spiritual sensitivity indicating that moral and ethical issues are at least to some extent present in both dimensions.

Discussion

Our major motivation, when operationalizing Gardner's MI theory into the MIPQ, is to provide both learners and their supervisors practical tools for meaningful self-reflection regarding each one's potentials. Perceptions of individual strengths are also connected to self-concept and attribution theory.

In addition, we are interested in the outcome aspect that is strongly present in the MI theory suggesting that academic intelligence alone is not enough. We need to recognize that success in life and career depends also on social, practical and environmental intelligence. It is also important to understand that the world does not revolve around human beings. We are not here alone but one of many and, thus, environmental sensitivity is needed. Our wish is that this study will help to promote discussion around above-mentioned topics.

When discussing about the usefulness of the MI scales presented here, we refer to the endless debate about the use of self-report measures in scientific studies. Campbell (1982, p. 692) stated that " .. one possible exception [to exercise a professional bias] pertains to the use of a self-report questionnaire to measure *all* the variables in a study." According to Crampton and Wagner (1994), various studies have been conducted to test the hypothesis that self-report questionnaires, if used as the only data collection methods, artificially elevate measures of covariation, producing percept-percept inflation in published correlations. However, when they conducted a large scale meta-analytic research involving 42,934 correlations published in 581 scientific articles, findings challenged the validity of general condemnations of self-report methods showing that percept-percept inflation did not have the broad, comprehensive effects envisioned by critics. We conclude that the best way to conduct scientifically valid research with self-report measures is to collect data with empirically tested instruments that are based on solid theoretical research, and report all the phases of study design and operationalization explicitly.

Our findings give important information to teachers and educators on how gender influences the self-perception of students' abilities. The educators and counsellors should be aware of the main trends of girls to rate themselves lower in logical-mathematical dimension than in the other ones. The girls should be encouraged to see their whole potential in that

dimension as well. Furthermore, the similarities in girls' and boys' ratings of their spiritual sensitivity opens new possibilities to holistic education where both sexes are educated for their whole potential including spiritual and moral domains.

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