

DEVELOPMENTAL AND CULTURAL ASPECTS OF FIELD-DEPENDENCE IN 11 AND 12 YEAR OLD ESTONIAN AND FINNISH STUDENTS

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Abstract. The aim of the study was to analyze the stability of the field dependence-independence (FDI) construct in a sample of 11 and 12 year old Estonian and Finnish elementary students. Scores on the Group Embedded Figures Test (GEFT) obtained at the end of grade five and at the end of grade six were compared. The findings revealed that Finnish students were more field-independent (FI) than field-dependent (FD) than Estonian children at both grade 5 and grade 6. Results clearly demonstrated that the number of FI children increased for both groups from grade 5 to 6. Generally, the results were consistent with previous research in regards to both developmental and cultural aspects of FDI.

Keywords: field-dependence, cultural differences, cognitive development, learning styles

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1. Introduction

The field dependence-independence (FDI) model of information acquisition, processing, and recollection represents one of the most widely researched cognitive styles in relation to human personality and learning (Guisande et al. 2007). According to Keefe (1979:9), FDI measures the degree to which an individual uses an “analytical as opposed to a global way of experiencing the environment”. The construct of field-dependence (FD) and field-independence (FI) has been shown to manifest across a broad spectrum of cognitive processing behaviors (e.g. Angeli and Valanides 2004, Guisande et al. 2012) and acknowledged as having important educational implications (Dewey 2004) that may influence the way teachers teach (Evans 2004) and the structuring of interactions between teachers and students (Saracho 2000). It is valuable, therefore, to foster a clearer understanding of the manner in which children process information, so as to facilitate improvements in

teaching and learning strategies that could benefit the educational outcomes of students in school settings.

In considering how FDI may affect the learning of children, the work of Jonassen and Grabowski (1993) serves as an appropriate descriptive platform. Specifically, when interacting with stimuli, children who are FD may find it difficult to locate the information they are seeking because it can become masked by other information within the stimulus field. Contrastingly, FI typically find it easier to recognize and select the critical information from the surrounding field. Furthermore, when information is ambiguous and unstructured in its presentation, FI children will impose their own structure on the information. Children who are FD, however will attempt to understand and learn that information directly as it is presented and without restructure. An additional classification of the FDI construct is the intermediate or mobile style and represents a preference between FI and FD (Graff 2000, Witkin and Goodenough 1981). Graff (2000) suggested that this style may highlight versatility in wholistic and analytic preference, whereas, Witkin and Goodenough (1981) proposed that mobility of FDI may represent diversity in adaptation of preference. Finally, individuals that can adopt a style different from their dominant style demonstrate a capacity for interchangeability to suit their immediate evaluation of the information field (Saracho 2000). Overall, classification of FDI appears to be more commonly directed towards a two dimensional framework, however, recent research has incorporated the intermediate category (e.g. Guisande et al. 2012).

Continuing access to specific data regarding individual differences in cognitive style preference is important in framing pedagogical practice. Interestingly, in discussing children's learning patterns associated with cognitive style, Kleinfeld (1994) was firm in her acknowledgement that while it is necessary to be aware of different styles of learning, it is equally essential that teachers avoid narrowly matching their preferred teaching styles to the patterns of abilities shown by specific cultures at particular ages. Instead, teachers need to be conscious of both the influence of biological developmental and a unique societal effect that guide the approaches children utilize to learn inside and outside of their school settings. Cassidy (2004:421) highlighted that cognitive style in the learning domain may be considered as both a state and a trait, whereby an individual's style is "responsive to experiences and the demands of the situation (process) to allow change and enable adaptive behaviour". Furthermore, Cassidy's overview of the FDI cognitive style leads to the proposition that specific learning preference characteristics of FI (i.e. learning in isolation) and FD (i.e. integrated learning) individuals have implications for both learning situation and outcome.

Children of different ages and cultural backgrounds typically demonstrate variation in their preferred style pattern when engaging in the cognitive processes associated with learning. Bagley (1995) provided a perspective of how culture influences FDI surmising that children in group oriented cultures, that typically socialize for dependence and conformity demonstrate perceptual skills that are holistic and establish an integrated whole view of complex fields. In contrast,

children that are field-independent are more socially independent and have a greater capacity to differentiate self and nonself as an outcome of their analytical cognitive style. Cultural environments such as found in Estonia are possibly representative of the group oriented perspective (Nurmi and Üksvärav 1994), whereas the neighboring Finland may be better aligned with the individualistic framework (Pelkonen 2008). Societal factors pertaining to politics and economics are also influential in regards to the development of cultural behaviors. Estonia's political history meant that the current population is slowly evolving from a highly conformist way of life where the broader social collective was of principal importance (Mizera and Tulviste 2012, Randjärv 2013). The Finns have adopted Western approaches and allowed young people to adopt self-oriented lifestyles with a focus on achieving their own goals as the main priority (Tolonen 2013).

Research of the relationship between cognitive style and biological development across the chronological period of schooling has typically shown that styles do not remain static and may change as children get older. Witkin and his associates (1954, 1962) conducted a series of basic developmental studies of perceptual field-dependency. Results of this research indicated a general developmental pattern of decreasing field-dependency with increased age from childhood to early adulthood. Their findings further highlighted that this trend may eventually reverse, with increasing field-dependency being characteristic of the adult years. Moreover, in relation to the age period of 10–15 years, Arya and Mishra (2012) proposed that the general trend is that over this time a greater number of children demonstrate a tendency toward field-independence. Associated changes in general cognitive processing abilities such as working memory and attention have been proposed as possible influences in regards to this trend in FDI (Guisande et al. 2008, Nicolau and Xistouri 2011).

Recent studies also support that a clear developmental pattern exists in FDI, with findings indicating that both boys and girls become more field-independent with an increase in their age (e.g. Arya and Mishra 2012, Guisande et al. 2008, Guisande et al. 2012). Arya and Mishra (2012) recruited a sample of 220 school-children (111 boys and 109 girls) aged 7-12 years, and randomly divided the children into three age groups, (i. e. 7–8, 9–10, and 11–12 years). MANOVA results for the children's scores on the Story-Pictorial Embedded Figures Test (SPEFT) revealed that the older children were more field-independent than the younger children. Interestingly, the difference was significant only between the 7–8 years old students and both the 9–10 and 11–12 years old student groups, however, no significant difference was found between the latter two age groups. Guisande et al. (2012) examined whether children adopting a particular FDI style demonstrated differences in performance on tasks measuring aspects of memory and attentional functioning. The researchers assessed 149 children aged 8–11 years and classified them according to FDI into three styles (field-dependent, intermediate, or field-independent) using the Children's Embedded Figures Test (CEFT). One way ANOVA results of the children being grouped according to age indicated a significant age effect. However, post hoc results revealed a significant

difference only between the cohorts of 8- and 11-year-olds. Overall, findings reported in these studies support the proposition that children become more field-independent over time but that differences are more apparent when the interval between the age cohorts is two or more years.

Findings associated with cultural variation in cognitive processes have demonstrated that different societal and ethnic groups foster quite different modes of cognitive processing (Kitayama 2000, Nisbett et al. 2001). In particular, individuals engaging in Western style cultures are assumed to be relatively more attuned to a focal object and less sensitive to context. They are described as analytic (Nisbett et al. 2001) or field-independent (Witkin and Berry 1975) in their cognitive style, and primarily pay attention to the object and the categories to which it belongs and use rules, including formal logic, to understand its behavior. Conversely, persons engaging in Eastern cultures are considered to be more attuned to contextual information and are described as holistic or field-dependent in cognitive style (Nisbett et al. 2001). These individuals normally attend to the entire field and ascribe causality to it, and make only limited use of categorization and formal logic, by tending to rely more their dialectical reasoning. Additional differences have been observed in other cultural FDI studies. For example, U.S. and German (individualist cultures) participants were more FI compared to Russian and Malaysian (collectivist cultures) participants (Kühnen et al. 2001). Nisbett et al. (2001) speculated that the origin of these differences is traceable to markedly different social systems.

Existing research focusing on cultural differences in children's cognitive processing has generally supported propositions derived from studies by Witkin (1978) and Berry (1991). This set of findings purport that children in group-oriented cultures (e.g. from Jamaica and in Native American populations), which socialize for dependence and conformity, will have perceptual skills that are holistic and will view complex fields as integral wholes. Field-independent children, in contrast, tend to excel in perceptual-disembedding tasks, and their analytical-cognitive style tends to reflect specialization for group independence, with a strong sense of self versus non-self differentiation (Bagley 1995).

Entwistle (1998) has surmised that the individual's adoption of specific learning strategies or styles does not necessarily represent inherent, fixed characteristics of the person but that their approaches are responsive to the environment and interpretation of that environment. It is critical, however, to acknowledge that although physiological, genetic, and other constitutional factors affecting learning and behavior are important, social, educational, and other environmental characteristics remain very influential. Dunn (1990) outlined that environmental and physical elements of cognitive style are more fixed, and that emotional and 'sociological' factors are more open to change. Additionally, more than half of an individual's cognitive style is biologically imposed, which therefore allows for the remaining portion of their preferred style to be influenced by factors that are framed by their cultural and social environments. In the current study, children's cognitive style construct was explored over one year time interval within the

cultural and societal settings of Estonia and Finland. The aim of the study was to analyze the stability of the FDI construct in a sample of 11 and 12 year old Estonian and Finnish elementary students, based on the comparison of their Group Embedded Figures Test (GEFT) scores obtained at the end of grade 5 and at the end of grade 6.

2. Method

2.1. Participants

Participants in this study were drawn from two culturally contrasting elementary school cohorts. The final student sample of 11- and 12-year-olds ($M = 11.31$, $SD = 0.46$) comprised 80 boys and 83 girls. The group of 70 Estonian pupils was from a single school in South of Estonia and the 93 Finnish pupils were from two schools in Central Finland. Following the consent from the schools' principals, students were asked if they would be willing to participate in a project that examines the development of a person's cognitive style during one year. Students participated in the study voluntarily, and their parents completed an informed consent form. The Ethics Committee of the local university reviewed and approved the study.

2.2. Measures

The present study utilized the Group Embedded Figure Test (GEFT) designed by Oltman et. al (2003). The GEFT is a paper-and-pencil instrument which requires students to attempt to discern simple geometric figures from more complicated patterns. Each complex figure included an embedded simple figure, which the subject is to identify as quickly as possible. The number of correct figures located is taken as the score on the GEFT. This score indicates the position of the individual in the field-independence/field-dependence cognitive style continuum. A high score indicates a relatively higher inclination towards analytical thinking (FI) or less inclination towards global thinking (FD).

2.3. Procedure

The participants completed the GEFT and provided basic demographic information regarding their gender, and age at testing during the final phase of their grade 5 year at school. The testing protocol requires the administration of the GEFT in three sections: an initial practice section of 7 items, completed over a 2-minute interval. Participants are then provided with an opportunity to discuss concerns or ask questions regarding the administration, completion or content of the measure. Following this, two sections, each comprising 9 items and requiring 5 minutes to finalize, are completed by the participants. The GEFT was administered a second time after a one year interval during the final phase of their grade 6 school year. All testing sessions were conducted by the first author in a classroom setting organized by the participating schools.

2.4. Statistical analysis

All statistical analyses were completed using SPSS Version 20. Means and standard deviations were calculated for all dependent variables and groups. Chi-square analysis was used to evaluate variation in the observed scores and the expected scores for the sample at grade 5 and grade 6 and according to both the two category format of FDI and the three category format. Repeated measures multivariate analysis of variance (MANOVA) and repeated measures t-tests were used to analyze both the grade and cultural groups differences for the GEFT scores. A preset alpha level of $\alpha = .05$ was used for all statistical procedures.

3. Results

3.1. Comparison of FDI stability for 2 and 3 categories

Differences in the categorizations of field-dependence/field-independence scale for both two (field-independent: 0–9 points and field-dependent: 10–18 points) or three subdivisions (field-independent: 0–6 points, mixed field-independent/dependent: 6–12 points, and field-dependent: 13–18 points) were examined to demonstrate that classifying FDI into either two or three subdivisions was not a major factor in any observed developmental progression due to stability/instability of FDI construct.

Chi-square analysis of the categorization of FDI scores into two subdivisions, $\chi^2(1, N = 163) = 54.23, p < .001$, revealed that 58.9% of the FD students at grade 5 maintain FD cognitive style through to the end of grade 6. Results also showed that the 41.1% of students who were FD people after the grade 5 scored higher on the GEFT, indicating a preference for the FI cognitive style after the grade 6. In contrast, 97.1% of students whose scores indicated a preference for the FI cognitive style at grade 5 maintained this preference at grade 6. Only 2.9% of participants who scores indicated a FI cognitive style preference at the end of grade 5 achieved scores indicative of preference for the FD cognitive style at the end of grade 6 (Table 1).

Chi-square analysis of the categorization of FDI scale scores into three subdivisions, $\chi^2(4, N = 163) = 99.88, p < .001$, showed that 49.1% of students who were FD at the grade 5 maintained scores indicative of the FD cognitive style at the end of the grade 6. Results also indicated that 45.5% of students who were

Table 1. Summary of FDI two level categorizations for the sample at grade 5 and grade 6

		FDI at Grade 6		
		FD (n =58)	FI (n = 105)	
FDI at Grade 5	FD (n = 95)	Count	56	39
		Percentage	58.9%	41.1%
	FI (n = 68)	Count	2	66
		Percentage	2.9%	97.1%

classified as FD at grade 5 achieved scores indicative of a mixed FDI cognitive style' at grade 6. Only 5.5% of students that were FD at grade 5 were FI at grade 6. In addition, 50% of students were intermediate cognitive style group at grade 5 maintained their cognitive style after grade 6. Results indicated 45.6% of the grade 5 intermediate group were FI at grade 6 and 4.4% of the sample changed from intermediate style to the FD style grade 6. In contrast, 95% of students who were FI at grade 5 maintained their FI style at grade 6 and only 5% who were FI at grade 5 changed to the intermediate style at grade 6 (Table 2).

Table 2. Summary of FDI three level categorization for the sample at grade 5 and 6

			FDI at Grade 6		
			FD (n = 30)	Intermediate (n = 61)	FI (n = 72)
FDI at Grade 5	FD	Count	27	25	3
	(n = 55)	Percentage	49.1%	45.5%	5.5%
	Intermediate	Count	3	34	31
	(n = 68)	Percentage	4.4%	50.0%	45.6%
	FI	Count	0	2	38
	(n = 40)	Percentage	0%	5.0%	95.0%

3.2. Contrast of grade 5 and grade 6 GEFT scores

The mean value of the field-dependence/independence (FDI) score construct was 8.98 ($SD = 4.62$) at the end of grade 5 and 11.39 ($SD = 4.67$) at the end of grade 6 for the whole sample. Repeated measures t test results indicated that a significant difference in FDI cognitive style construct existed between the grade 5 and grade 6 measurements, $t(163) = -9.84$, ($p < .001$).

3.3. Differences in the FDI construct and cultural background

Repeated measures MANOVA of Finnish and Estonian participants' fifth grade GEFT scores (9.97 and 7.70, respectively) and Finnish and Estonian participants' sixth grade GEFT scores (12.2 and 10.32, respectively) revealed no significant interaction effect for nationality and age (see Figure 1). A significant difference was found between subjects comparison, Wilks' $\Lambda = .62$, $F(1, 161) = (9.467)$, $p = .002$, $\eta^2 = .36$). Finnish students were significantly higher in FI than the Estonian sample at both test occasions.

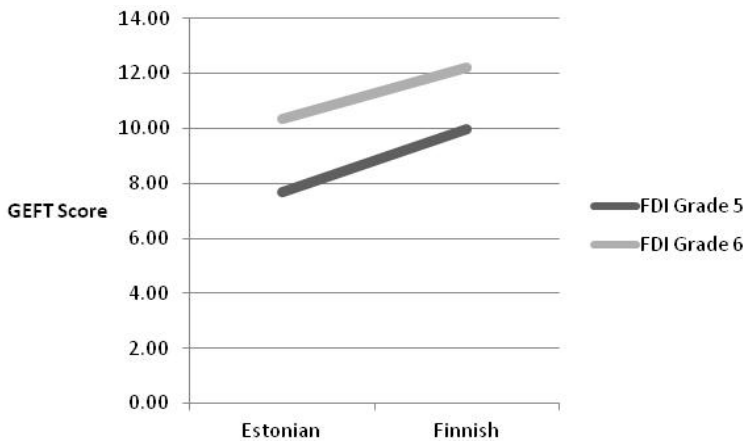


Figure 1. GEFT mean scores contrasts for age and nationality.

4. Discussion

The aim of the present study was to examine FDI stability in 11 and 12 year old students over one year time frame by comparing their cognitive styles, as defined by GEFT scores, obtained at the end of grade 5 and grade 6. Estonian and Finnish cultural environments were contrasted through the representation of the schools that the students attended. The findings revealed that Finnish students were more FI than FD than the Estonian children at both grade 5 and grade 6. Results clearly demonstrated that the number of FI children increased for both groups from grade 5 to 6. Generally, the results were consistent with previous research in regards to both developmental and cultural aspects of FDI (e.g. Guisande et al. 2012, Kühnen et al. 2001).

4.1. Chronological-developmental changes and FDI

Results associated with the analyses of variations in FDI scores support the general findings of the earlier studies that indicate that FDI characteristics change as children develop chronologically (e.g. Arya and Mishra 2012, Witkin 1962). Younger children are typically field-dependent but become more field-independent as they move into adolescence and early adulthood. Guisande et al. (2008) provided a strong overview of how changes in cognitive processing may stimulate FDI patterns. Characteristics such as working memory capacity, improved operational efficiency of working memory, capability to manage and utilize memorial resources, and functional attention might contribute to the change patterns observed in any transitions from FD to FI preference.

In the current research, results demonstrated a significant shift in the scores of children in FDI from grade 5 to grade 6, represented by the trend of an increase in the number of FI children and a decrease in the number of students who had scores

indicative of FD. These findings were similar to those reported by Arya and Mishra (2012) and Guisande et al. (2012) in which children in the age range of 7–12 years were shown to attain FDI scores that clearly indicated that across the childhood and early adolescence time period an increase in the number of children with a preference for FI is expected. Reinforcement from both current and previous research that this pattern is typical, serves as a valuable insight of children's cognitive processing characteristics of benefit to educators. Further to this, studies that work towards establishing deeper links between FDI and perceptual, social recognition, attentional, and memorial aspects of cognition contribute important information regarding learning and cognitive style.

As depicted in Figure 1 an important element of the changes observed for all participants was that irrespective of cultural background a trend from FD to FI was consistent in relation to age. In considering the ideas of Willing (1988), education systems tend to produce a more analytical mode of thinking. Dewey (2004) proposed that analytic thought is a dominant paradigm in schools not because it is better in all situations but because it can be taught, and is required for many technical skills. Thus, students' engagement within the typical school teaching and learning setting may contribute to the refinement and development of analytical thinking. The change in GEFT scores we observed may not only reveal the chronological adaptation of a shift from FD into FI, but highlight how students may respond step by step to a more analytical style in their studies as an outcome of their everyday participation in schools.

4.2. Cultural background and FDI

Analyses of GEFT scores for the Estonian and Finnish samples clearly indicated that the Finnish cohort had higher scores and a greater number of students with a preference for FI cognitive style at both grade 5 and 6. Cultural differences in FDI have previously been attributed to variations in socialization characteristics such as conformity or personal independence, both of which can influence an individual's preference for either a holistic or an analytic cognitive style (Bagley 1995, Nisbett et al. 2001). Kagan (1974) concluded that differences in FDI between Mexican and Anglo-American children were likely to be an outcome of the tendency for conformity demonstrated by the Mexican children who were also more field-dependent as a group. Using tasks associated with holistic and analytic approaches to cognition, Duffy et al. (2009) proposed that differences observed between Japanese and North American children may reflect how approaches to cognitive processing are possibly bound by how one generation of a culture works to socialize the next to adopt a similar cognitive processing strategy.

Specifically, in relation to the current findings three aspects may have influenced Estonia's cultural environment differently in comparison to the Finnish cultural environment. Firstly, for 50 years Estonia was bound by two generations of socialism, characterized by social ownership that has influenced the population towards maintaining a holistic perception of the cultural environment. Secondly,

the political phenomena of collaborationism and conformism in Estonia during the Soviet annexation period were marked by an ideological pressure from the Communist Party. Individuals were limited as to how they could operate as independent thinkers and were restricted by the real fear of government repression or punishment (Randjärv 2013). Consequently, as an outcome Estonians became dependent on family and reliable friends (Nurmi and Üksväärv 1994), a possible stimulus for the social dependence and conformity typical of holistic and field-dependent thinking. Recent findings in relation to change in conformity values amongst Estonian high school students indicate that this attribute has remained salient over time (Mizera and Tulviste 2012). Finally, during the period of the Soviet rule many individuals who were more individualistic in their thinking left Estonia either as immigrants or as deportees, thus, biasing the social pool of FDI cognitive styles being represented on the FDI continuum in favor of FD.

In considering the cultural influences that may frame the observed preference by the Finnish students toward an FI style of thinking, three main ideas are applicable. Firstly, Finns have adopted and maintain many characteristics of Western, individual-based culture (Tolonen 2013). In modern Finland, society is built on individuals, not families. Individuals are therefore likely to operate in an independent analytic manner. Because the culture is focused on respecting the individual, conformity is not as critical as what may have been required in the Estonian cultural environment. Secondly, Finns are considered to be logical, calculated, gather background information in advance, and make decisions quickly, characteristics that could be considered to better constitute a FI cognitive style. This attribute is encouraged and fostered within the Finnish education system though a focus on the active learning of students (Kangas 2010). Finally, within the social milieu, power and responsibility are flexibly distributed and the endeavor of governance is to treat all individuals equally (Pelkonen 2008). Social power hierarchies are minimized, first names used, and men and women considered as equal. There is a desire to solve conflicts by negotiation, seeking outcomes that serve the goals of all involved. Overall, this set of attributes which represent the larger cultural environment are indicative of an analytic approach to thinking and support the development of a preference toward FI that we observed in the current Finnish sample of children.

The current study was limited by the brevity of the data collection interval. A clearer picture in relation to the trends found here could have been achieved by a longitudinal sequence of FDI evaluations occurring over 3 or 4 year interval as the children fully develop into adolescents. Involving students from only a small number of schools also serves as a limitation to generalizability of the findings. Sourcing a spectrum of educational settings with focuses such academics, performing arts, or sport, in addition to mainstream schools would have allowed results to be considered with a broader applicability. From a measurement perspective, although the GEFT has been used with 11–12 year old children previously (Holmes et al. 2013), other studies have shown a preference for the Children's Embedded Figures Test (CEFT) (e.g. Guisande et al. 2012). For the

current study, the organization supplying the measure provided support suitable for children of these ages.

Findings generated within the current study provide additional evidence in regards to children's development of their cognitive style, and the possible effects of cultural background associated with FDI preferences. Consistent with the existing research and theory, both the Estonian and Finnish 11 year old children transitioned to a greater preference for FI as they got older. Differences in FDI between the two samples highlight that societal influences may still frame how cognitive style is operationalized by children. A range of future research possibilities exist to follow up studies of this investigation. A longitudinal study would serve to substantiate the tentative findings of the present research. Data collection at yearly intervals across a 4 to 5 year period could provide additional insights into the developmental underpinnings of the FDI construct. Maintaining the contrasts between the two cultures, and the introduction of additional social cohorts within the longitudinal framework, could identify if the globalization of youth within cultures has any effect on preferences associated with cognitive style. Although the recent research specifically related to Witkin's original FDI theory has been limited, the basic support of the construct's viability shown within the current samples can hopefully stimulate renewed interest in extending and developing exploration of the FDI theory.

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