

The Factor Structure of the Tacit Knowledge Inventory for High School Teachers in a Greek Context

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Abstract

This study presents the factor structure underlying Tacit Knowledge Inventory for High School Teachers (TKI-HS) which constitutes an informative measure for the assessment of experienced-based tacit knowledge of Greek secondary school teachers, as well as the effect of the teaching experience factor on teachers' preferred strategies for their workplace interactions. The aim of this study was to provide an insight into the factor structure underlying this instrument in a Greek context, as the structure of its factors has only been assessed in a limited European context. The sample consisted of 279 high-school teachers, 83 men (29.7%) and 196 women (70.3%) who varied in the amount of teaching experience, ranging from 1 to 19 years. The participants completed a Greek version of the TKI-HS inventory consisting of 11 scenarios, each of which provides seven strategies as a framework for evaluating teachers' responses to potentially challenging social situations. Confirmatory factor analyses verified the single-factor structure of each of the seven strategies, which were included in each of the 11 scenarios of the Greek version of the TKI-HS inventory, confirming, in total, a slightly different structure of the Greek version of the TKI-HS Inventory from the one suggested by the inventory designers. Teaching experience has been found to have a small effect on the respondents' choice of tacit knowledge strategies for their interpersonal interactions. Implications for future research were identified and discussed.

Keywords

Factor Structure, Interpersonal Interactions, Practical Intelligence, Tacit Knowledge Inventory for High School Teachers

1. Introduction

Teaching is not only about instructional delivery but also about interpersonal interactions. Although teachers don't lack competence and effectiveness in their academic subject knowledge or pedagogical knowledge, their interpersonal competence is quite limited as they only receive little training on issues related to the negotiation of interpersonal interactions (Elliott, Stemler, Sternberg, Grigorenko, & Hoffman, 2011; Hobson, Malderez, Tracey, Giannakaki, Pell, & Tomlinson, 2008). For many teachers, the most demanding part of their job relates to their relationships with their students (Johnson & Birkeland, 2003). The primary concern of each teacher at the beginning of his/her career is a potential conflict with his/her students and his/her ability to create positive classroom environments. However, in the very first years of their educational experience, tensions with their peers and their principals also become apparent (Beach & Pearson, 1998). Educational practice and performance are constantly under increased external scrutiny and educational work is often challenged by parents, principals or even students themselves, hampering smooth collaboration. Apparently, teachers are often confronted with a series of pedagogical, cultural, and political dilemmas that confuse them in choosing the best way to build relationships with their students, their students' parents, and their peers. A teacher needs strong social and interpersonal skills to deal with others and self-management skills to deal with self (Scully, Pitsia, & Karakolidis, 2019). That makes these practical skills particularly important in the context of teaching. Experience in this case can be viewed as a necessary condition for the acquisition of these skills since what the individual learns from experience is instrumental in the learning process (Sternberg, Forsythe, Hedlund, Horvath, Snook, Williams, Wagner, & Grigorenko, 2000). The ability to learn from experience is a key to success in almost any domain (Matthew & Sternberg, 2009; Schön, 1983). What is not well understood is how individuals learn from experience (Hedlund, Antonakis, Sternberg, 2002).

Is it possible to develop training methods that facilitate the acquisition of experience-based knowledge? This study is about a measurement instrument constructed to assess teachers' experienced-based tacit knowledge, namely their ability to think with practical pedagogical knowledge (Grigorenko, Sternberg, Strauss, 2006). Tacit knowledge serves as a measure of the ability to learn from experience (Hedlund, Antonakis, Sternberg, 2002). The results of such assessments could help to improve our understanding of teachers' practices and enable insight into the nature and development of teachers' tacit knowledge while also providing a systematic framework of possible ways of responding to the numerous social interactions that teachers face in their working environment.

1.1. Tacit Knowledge as an Important Aspect of Practical Intelligence

The way we treat others in our interpersonal relationships is considered to be an important component of practical intelligence. According to the triarchic theory of successful intelligence (Cianciolo, Matthew, Sternberg, & Wagner, 2006; Sternberg & Grigorenko, 2002; Sternberg & Hedlund, 2002; Sternberg, 1997, 1999, 2001a, 2001b, 2005), practical intelligence is the basis for acquiring and utilizing tacit knowledge (Polanyi, 1966), that is the procedural knowledge that guides a person's behavior and whose practical value lies in enabling people to achieve goals that are important in everyday life situations (Sternberg, Wagner, & Okagaki, 1993).

Practical intelligence relates to the ability to acquire and use knowledge related to real, everyday problems, such as those arising in the workplace or at home, that is, to learn from one's own experience. The practical ability to learn from experience involves cognitive processes through which tacit knowledge is applied to the way of solving practical problems in new experiences and amended by these new experiences (Cianciolo et al., 2006; Grigorenko, Meier, Lipka, Mohatt, Yanez, & Sternberg, 2004; Sternberg & Hedlund, 2002; Sternberg, 2005). Tacit Knowledge (TK) for teaching has been shown to be related to professional effectiveness (Grigorenko, Sternberg, & Strauss, 2006), as it has for many other occupations requiring high-level expertise. So, it would appear to be useful for teachers to receive more structured and systematic training on potential strategies for dealing with the various social situations they encounter on a daily basis so as to develop their tacit knowledge which would help them improve their expertise (Scully, Pitsia, & Karakolidis, 2019). However, assisting teachers to manage the challenges inherent in the interpersonal domain of school life is a challenging goal since it is quite difficult for mentors to render their knowledge accessible, as much of it is tacit. That makes it hard to be made explicit as a set of guiding rules for action (Sternberg, 2001a, 2001b; Sternberg & Horvath, 1995). In addition, teachers are often unaware of the skills they bring to bear in relation to the management of difficult interpersonal encounters, so describing or analyzing this implicit knowledge is almost impossible (Elliott & Stemler, 2008).

Research undertaken by Sternberg and his colleagues (Elliot et al., 2011; Sternberg et al., 2000) was an attempt to assess and examine the nature and development of teachers' TK concerning their relations to significant others and aimed at identifying and describing potential resolution strategies as a response to challenging social situations.

1.2. Development of TK Inventories

Therefore, TK inventories have been developed utilizing a Situational Judgment (SJ) format. Situational Judgment Tests (SJTs) have been found to be useful for assessing the construct of practical intelligence via assessments of TK (Stemler & Sternberg, 2006). The measurement of TK was based on investigating the differences between experts in this professional field compared to their novice peers (Sternberg et al., 1993). Content analysis of the responses collected enabled

the researchers to look for trends across different situations (Stemler, Elliott, Grigorenko, & Sternberg, 2006). They arrived at seven practical strategies used to deal with “others”, which can be applied across a variety of social situations, namely: “avoid”, “comply”, “consult”, “confer”, “delegate”, “legislate”, “retaliate” (Stemler & Sternberg, 2006; Stemler et al., 2006). The identification of strategies resulted from the observed behaviors associated with each practical strategy.

Although there is a finite number of situations and strategies for handling them in different contexts, the ability to identify the best match between the handling strategy and the situation within a specific cultural context provides a measurable demonstration of the respondent’s tacit knowledge. The way a person chooses to manage his/her interpersonal interactions is not only the result of individual differences but also the extent to which that person is able to resort to a systematic context of different alternatives, through which he/she will choose the handling way he or she considers as the most appropriate for every interpersonal interaction he/she has to deal with (Stemler & Sternberg, 2006; Stemler et al., 2006).

The seven practical strategies outlined above provide a framework for assessing the potential reactions to a variety of situations that a teacher might come across, during his or her career, as they include a wide range of the most common forms of action (Stemler et al., 2006). Stemler and his colleagues developed three separate TK Inventories for elementary, middle and high school teachers respectively, as they found that the types of issues faced by each group of teachers were different, so that separate TK SJTs were required for their estimation.

It is important to note though, that no strategy is uniformly the best option in all situations, as there are advantages and disadvantages to each strategy. It is also important to note that the same behavior may arise due to different intentions. Consequently, skillful handling of a “demanding” situation requires not only the ability to choose the best strategy but also the ability to implement it effectively, as the situation is developed/running on (Elliot et al., 2011).

2. The Present Study

As far as we know, there are small number of studies regarding the Tacit Knowledge Inventory for High School teachers and these concern English, Irish and Russian cultures (Stemler, Elliot, O’Leary, Scully, Karakolidis, & Pitsia, 2018; Scully et al., 2019) and the adaptation of TK Inventories for (Elementary, Middle and High School) teachers is still assessed in European context. Therefore, the primary objective of this study was to provide an insight into the factor structure underlying the Tacit Knowledge Inventory for High School Teachers (TKI-HS) in a Greek context.

Although research on TK supports the relationship between knowledge and experience, there are a few exceptions. These findings suggest that the relationship between experience and tacit knowledge is not fully resolved (Hedlund, Antonakis, Sternberg, 2002). In order to further clarify the role of experience in respondents’ choice of TK strategies for their workplace interactions, investigating the effects of teaching experience was considered a secondary objective of the study.

Hypotheses

Consistent with the structure proposed by the inventors (Stemler et al., 2006) of TKI-HS that the 77 items of the 11 scenarios' inventory are loading, per 11, on one of the seven types of practical strategies, namely: "Avoid", "Comply" "Consult", "Confer", "Delegate", "Legislate" and "Retaliate", we expected to verify a uni-factorial structure for each of the seven strategies of the Greek version of TKI-HS inventory (Hypothesis 1a, H1a).

Since we have not identified any information on the further organization of the seven types of TKI-HS strategies in the context of the literature review, we attempted an initial investigation of their factor structure in order for us to be able to determine whether, into the Greek culture, they are organized into more than one broader factors (groups), for example, into "good" and "bad" strategies (responses), although no strategy is uniformly the best option in all situations (Hypothesis 1b, H1b).

Only a small effect of the teaching experience on the tacit knowledge of the participating teachers was expected (Hypothesis 2a, H2a) as the research data on the relationship between TK and experience are contradictory. There are findings that support the direct impact of experience on acquiring tacit knowledge (Borman, Hanson, Oppler, & Pulakos, 1993; Herbig, Bussing, & Ewert, 2001; Marchant & Robinson, 1999; Patel, Arocha, & Kaufman, 1999) or confirm an increase in tacit knowledge through experience (Sternberg et al., 2000; Wagner, 1987; Wagner & Sternberg, 1987; Wagner, Sujana, Sujana, Rashotte, & Sternberg, 1999). However, there is also the claim that tacit knowledge is more a result of biological predisposition than experience (Patel et al., 1999; Torff, 1999), as well as findings suggesting that tacit knowledge cannot be taught and that one cannot be trained in it (Brockmann & Anthony, 1998).

3. Method

3.1. Participants

There are findings that support the direct effect of experience on the acquisition of tacit knowledge (Borman et al., 1993; Herbig et al., 2001; Marchant & Robinson, 1999; Patel et al., 1999) or others that confirm the increase of tacit knowledge through experience (Sternberg et al., 2000; Wagner, 1987; Wagner et al., 1999; Wagner & Sternberg, 1987). Therefore, the selection criterion of the participating teachers was their teaching experience. The sample of this study was mainly consisted of teachers with approximately 5 or more years of teaching experience, since according to most studies, teachers with this range of teaching experience are characterized as experienced (Gatbonton, 1999; Martin, Yin, & Mayall, 2006; Richards, Li, & Tang, 1998; Tsui, 2003, 2005). In particular the total sample consisted of 279 adults, 83 men (29.7%) and 196 women (70.3%). Participants' age ranged between 29 - 59 years. All participants were high-school teachers varied in the amount of their teaching experience, ranging from 1 to 19

years. In specific, 16 participants (5.7%) had up to 4 years of experience, 96 (34.4%) had 5 - 9 years of experience, 95 (34.1%) had 10 - 14 years of experience and 72 (25.8%) had 15 - 19 years of teaching experience. The participants, collectively, represented all subject areas.

3.2. Measure

Tacit Knowledge Inventory for High School Teachers (TKI-HS)

TKI-HS is one of the three separate TK Inventories—for elementary, middle and high school teachers—that [Stemler and Sternberg \(2006\)](#) developed for the estimation of teachers' tacit knowledge as to the appropriate way to interact with people in their immediate and broader professional environment ([Stemler et al., 2006](#)).

Teachers' interpersonal competence is assessed through their responses to the 11 written hypothetical scenarios included in TKI-HS inventory, which are related to school life and describe an interpersonal difficulty or challenge. The problems described in the scenarios are consistent with the types of issues faced by teachers in the school grade they are teaching. Each of the 11 scenarios falls into one of the following four categories: 1) relationships with students, 2) relationships with other teachers, 3) relationships with supervisors, and 4) relationships with parents. The scenarios, as well as the set of the alternative solutions provided as possible responses to each of the problems described, were elicited from structured interviews conducted in advance with experienced teachers ([Grigorenko et al., 2006](#); [Stemler & Sternberg, 2006](#)). Teachers were asked to describe any conditions they encountered during the course of their professional careers, for the handling of which they had not received prior formal guidance. According to the findings from the content analysis of the initial interviews, seven different types of strategies were identified that apply to a wide range of conditions: 1) "Avoid" (ignore the problem or avoid getting involved in the situation described), 2) "Comply" (do whatever I am asked to, by whomever may require it), 3) "Confer" (discuss the problem with the person who causes it, attempting to provide a reasonable explanation of my point of view), 4) "Consult" (turn to someone else for advice or ask for mediation to resolve the problem), 5) "Delegate" (delegate responsibility for resolving the problem onto someone else), 6) "Legislate" (introduce new policies to deal with future situations, similar to the one described), and 7) "Retaliate" (react directly as an act of revenge toward an aggressor without any intention of improving the situation).

Response options were designed from the outset to fit one of the seven types of strategies and their ordering was counterbalanced across items in each scenario so that responses that reflect specific strategies did not always occur in the same order. After reading each of the 11 scenarios, the participants were asked to rate the appropriateness of each of the seven strategies provided as a resolution response to the practical problem described in each of the 11 hypothetical scenarios included in the TKI-HS inventory, using a 5-point Likert scale ranging from (1) "strongly disagree" to (5) "strongly agree".

For the translation of the TKI-HS inventory in Greek, we followed the International Test Commission (ITC) guidelines (www.intestcom.org). Back translation procedure was also followed for the elimination of any inconsistencies that would disrupt the accuracy of the results.

3.3. Data Collection and Scoring

Participants were recruited from 50 different schools of the islands of Creta and Cyclades, and the city of Thessaloniki in Greece. Information about the research and its purpose was given to participants prior to the administration of the measure. They were also informed of the voluntary nature of the whole procedure and reassured about the confidentiality of all results. A written informed consent was obtained for all the participants who were subsequently asked to fill out an individual-demographics form. The TKI-HS inventory was administered by the first author to the participants, either individually or in groups of 3 - 4 persons, in a quiet environment—in the area of the school building (school library, teachers' office) where each participant teacher worked—so as to minimize the presence of any disruptions and disturbances. Testing was typically conducted in 30' (minutes). No incentives or compensation were offered to participants.

3.4. Statistical Analyses

The structure of the TKI-HS inventory designed by [Stemler and his colleagues \(2006\)](#) suggests that the 77 items of the 11 hypothetical scenarios' inventories are loading, per 11, on one of the seven types of strategies. Considering the aforementioned suggestion, we used Confirmatory Factor Analyses on the data collected from the 11 items, corresponding to each of the seven strategies to determine their level of fit with the model suggested by the TKI-HS inventors.

Structural equation models were conducted in EQS 6.1. and were performed on covariance matrix using the Maximum Likelihood estimation procedure. The Wald test was used to suggest more restricted models ([Bentler, 2005](#)). A non-statistical significance of the χ^2 -test indicates that the implied theoretical model significantly reproduces the sample variance-covariance relationships in the matrix. Since this test is sensitive to sample size, model fit was also evaluated by using the root mean squared error of approximation (RMSEA). The RMSEA tests how well the model would fit the population covariance matrix. A rule of thumb is that $RMSEA < .06$ indicates close approximate fit ([Brown, 2006](#)). The Comparative Fit Index (CFI) which is one of the indexes assessing the relative improvement in fit of the researcher's model compared with a baseline model was also used. A rule of thumb for the CFI is that values close to .95 or greater may indicate reasonably good fit of the researcher's model ([Brown, 2006](#)). In addition, model fit was evaluated by using the standardized root mean squared residual (SRMR). The SRMR is a measure of the mean absolute correlation residual, the overall difference between the observed and the predicted correlations. Values of

the SRMR less than .08 are generally considered favorable (Brown, 2006; Kline, 2005).

Furthermore, we used Exploratory Factor Analysis (EFA) to determine the numbers of factors (Mulaik & Millsap, 2000) underlying the 7 strategies of the Greek version of the TKI-HS inventory. EFA was conducted in SPSS 22.0. For the extraction of factors, we used the Principal Component Analysis method. In addition, we used the Eigenvalue criterion for the number of factors to be extracted and the scree plot for the selection of the factors. The value of the percentage and variance explained method was also taken into consideration.

Finally, for the investigation of the effect of teaching experience on the choice of the seven types of TKI-HS strategies, we conducted one-way analysis of variance (ANOVA).

4. Results (CFA Results)

4.1. Test of the Factor Structure of the TKI-HS “Avoid” Strategy

In order to test the single-factor structure of the “avoid” strategy, CFA was applied to data collected from the 11 items that, according to TKI-HS inventors, load on the “avoid” strategy (factor).

The initial MA.1 (MA.1 model: M = Model, A = avoid) model was unacceptable according to various measures of fit: [$\chi^2(44, N = 279) = 85.588, p < .001, \chi^2/df = 1.94, CFI = .724, SRMR = .062, RMSEA = .058$ (CI 90% .04 - .08)]. For this reason, we proceeded with the identification of the areas of the model that contributed most to the misfit. Residual analysis was conducted and the Wald and Lagrange Multiplier Tests were performed. Different models were tested and the modifications indicated by the aforementioned tests were included in the model being tested each time. The modifications improved the fit of the final MA.2 model on all indices. The fit of the MA.2 model was fully acceptable: [$\chi^2(12, N = 279) = 6.094, p = .911, \chi^2/df = .507, CFI = 1.000, SRMR = .025, RMSEA = .000$ (CI 90% .000 - .024)] (see Brown, 2006; Hu & Bentler, 1999; Kline, 2005). The single-factor structure of the “avoid” strategy that was finally confirmed, comprises 7 items, which are presented in Table 1.

4.2. Test of the Factor Structure of the TKI-HS “Comply” Strategy

In order to test the single-factor structure of the “comply” strategy, CFA was applied to data collected from the 11 items that, according to TKI-HS inventors, are comprised in the “comply” practical strategy.

The initial MB.1 (MB.1 model: M = Model, B = comply) model was unacceptable according to various measures of fit: [$\chi^2(44, N = 279) = 88.717, p = .001, \chi^2/df = 2.01, CFI = .688, SRMR = .062, RMSEA = .060$ (CI 90% .04 - .08)]. So, we proceeded with the identification of the areas of the model that contributed most to the misfit. Residual analysis was conducted and the Wald and Lagrange Multiplier tests were performed. Different models were tested and the modifications indicated by the aforementioned tests were included in the model being tested

Table 1. Model MA.2 for the structure of the 7-item version of the Greek TKI-HS “avoid” strategy (standardized solution).

| Items | “Avoid” strategy | E | R2 |
|---|------------------|------|------|
| A6. Ms. Johnson should deflect the issue by changing the topic of the conversation | .452 | .892 | .404 |
| D7. Ms. Wilson should tell Susan’s father that she is on her way to a meeting and will call him back (with no intention of doing so). | .709 | .706 | .502 |
| E2. Mr. Moore should ignore William’s inappropriate behavior. | .314 | .949 | .099 |
| G6. Mr. Jackson should not make an issue out of it. | .287 | .958 | .082 |
| H1. Ms. Martin should start looking for a job at another school. | .373 | .928 | .139 |
| I3. Given the personal risks to his own safety, Mr. Robinson should ignore the behavior as he is not responsible for dealing with fights out of school hours. | .444 | .896 | .197 |
| J2. Ms. Young should smile warmly without committing herself and then go out to dinner with her husband. | .293 | .956 | .086 |
| Items’ Measurement Errors Correlations | | | |
| D7-A6 –.308 | | | |
| J2-H1 –.213 | | | |

Note: All loadings and correlations presented indicate statistically significant associations ($p < .05$).

each time. The modifications improved the fit of the final MB.2 model on all indices. The fit of the MB.2 model was fully acceptable: [$\chi^2(11, N = 279) = 9.138, p = .609, \chi^2/df = 0.83, CFI = 1.000, SRMR = .028, RMSEA = .000$ (CI 90% .000 - .054)] (see Brown, 2006; Hu & Bentler, 1999; Kline, 2005). The single-factor structure of the “comply” strategy, that was finally confirmed, comprises 7 items, which are presented in Table 2.

4.3. Test of the Factor Structure of the TKI-HS “Confer” Strategy

In order to test the single-factor structure of the “confer” strategy, CFA was applied to data collected from the 11 items that, according to TKI-HS inventors, are comprised in the “confer” practical strategy.

The initial MC.1 (MC.1 model: M = Model, C = confer) model was unacceptable according to various measures of fit: [$\chi^2(44, N = 279) = 79.578, p = .001, \chi^2/df = 1.8, CFI = .748, SRMR = .058, RMSEA = .054$ (CI 90% .034 - .072)]. Modifications indicated by the Wald and Lagrange Multiplier tests and Residual analyses were included in the final MC.2 model and improved its fit on all indices. The fit of the MC.2 model was fully acceptable: [$\chi^2(32, N = 279) = 36.662, p = .261, \chi^2/df = 1.14, CFI = .966, SRMR = .042, RMSEA = .023$ (CI 90% .000 - .052)] (see Brown, 2006; Hu & Bentler, 1999; Kline, 2005). The single-factor structure of the “confer” strategy that was finally confirmed, comprises 10 items, which are presented in Table 3.

Table 2. Model MB.2 for the structure of the 7-item version of the Greek TKI-HS “comply” strategy (standardized solution).

| Items | “Comply” strategy | E | R2 |
|--|-------------------|------|------|
| B4. Mr. Brown should let the mother explain her view and when she has finished, try to find some point they agree on. | .547 | .837 | .299 |
| C5. Mr. Miller should adjust the program so as to discard the content the parent is concerned about. | .222 | .975 | .049 |
| D3. Ms. Wilson should tell Susan’s father that she understands his concerns and is reassured now that they’ve had an opportunity to talk things through. | .439 | .898 | .193 |
| F4. Ms. Thomas should change the elements of her teaching (e.g., content, subject, tasks or method). | .238 | .971 | .056 |
| G2. Mr. Jackson should try to put more effort into future projects. | .417 | .909 | .174 |
| H5. Ms. Martin should ask the principal for suggestions on how to improve her performance. | .485 | .874 | .236 |
| J4. Ms. Young should take her husband to the game and go together to dinner afterward. | .335 | .942 | .112 |
| Items’ Measurement Errors Correlations | | | |
| F4-C5 | .121 | | |
| J4-D3 | -.186 | | |
| G2-F4 | .161 | | |

Note: All loadings and correlations presented indicate statistically significant associations ($p < .05$).

Table 3. Model MC.2 for the structure of the 10-item version of the Greek TKI-HS “confer” strategy (Standardized solution).

| Items | “Confer” strategy | E | R2 |
|---|-------------------|------|------|
| B6. Mr. Brown should ask the mother to meet in person so they can talk about the topic in a calm and polite way. | .422 | .907 | .178 |
| C1. Mr. Miller should explain to the mother the reasons why he believes the program is so valuable. | .327 | .945 | .107 |
| D4. Ms. Wilson should explain why she became suspicious about Susan’s work, mentioning her low quiz and test scores. | .488 | .873 | .238 |
| E6. Mr. Moore should speak to William privately about his rudeness in class. | .367 | .930 | .135 |
| F2. Ms. Thomas should talk to the students one at a time after class. | .327 | .945 | .107 |
| G5. Mr. Jackson should talk to the department chair and tell him that he does not feel appreciated. | .164 | .987 | .027 |
| H7. Ms. Martin should tell the principal that she has been hurt by the public criticism of her work. | .299 | .954 | .090 |
| I1. Mr. Robinson should break up the fight and then talk to the boys about the problems that result when fights take place in school. | .258 | .966 | .066 |
| J7. Ms. Young should explain to Dennis that she has made a prior commitment. | .504 | .864 | .254 |
| K2. Ms. King should talk to Charles. | .226 | .974 | .051 |
| Items’ Measurement Errors Correlations | | | |
| J7-B6 | -.223 | | |
| H7-C1 | -.175 | | |
| K2-G5 | -.251 | | |

Note: All loadings and correlations presented indicate statistically significant associations ($p < .05$).

4.4. Test of the Factor Structure of the TKI-HS “Delegate” Strategy

In order to test the single-factor structure of the “delegate” strategy, CFA was applied to data collected from the 11 items that, according to TKI-HS inventors, are comprised in the “delegate” practical strategy.

The initial MD.1 (MD.1 model: M = Model, D = Delegate) model was not acceptable according to various indices of fit: [$\chi^2(44, N = 279) = 99.849, p = .001, \chi^2/df = 2.26, CFI = .828, SRMR = .063, RMSEA = .068$ (CI 90% .05 - .08)]. Thus, we re-estimated the model considering the modifications indicated by the Wald and Lagrange Multiplier tests as well as the Residual analyses. The final MD.2 model achieved a better level of fit according to all indices: [$\chi^2(31, N = 279) = 47.437, p = .029, \chi^2/df = 1.53, CFI = .948, SRMR = .046, RMSEA = .044$ (CI 90% .014 - .067)] (see Brown, 2006; Hu & Bentler, 1999; Kline, 2005). The single-factor structure of the “delegate” strategy that was finally confirmed, comprises 10 items, which are presented in Table 4.

Table 4. Model MD.2 for the structure of the 10-item version of the Greek TKI-HS “delegate” strategy (standardized solution).

| Items | “Delegate” strategy | E | R ² |
|--|---------------------|-------|----------------|
| A4. Ms. Johnson should tell Robert that she will have to check with the principal to see if it is ok for a teacher to have coffee with the student because it is really up to the principal. | .165 | .986 | .027 |
| B7. Mr. Brown should end the conversation and ask the assistant principal to deal with the situation. | .499 | .867 | .249 |
| C2. Mr. Miller should tell the student’s mother that she should talk to the principal and try to have her son placed into a different English class. | .481 | .876 | .232 |
| D5. Ms. Wilson should tell Susan’s father that she can put him in touch with the assistant principal who can field his concerns. | .611 | .792 | .373 |
| E7. Mr. Moore should send William to the principal. | .440 | .898 | .194 |
| F1. Ms. Thomas should send them all to the assistant principal’s office. | .483 | .876 | .233 |
| G4. Mr. Jackson should ask a colleague to advocate for him. | .513 | .858 | .263 |
| H6. Ms. Martin should ask a trusted colleague to speak to the principal on her behalf. | .405 | .914 | .164 |
| I2. Mr. Robinson should get the assistant principal or another administrator to break up the fight. | .345 | .939 | .119 |
| J6. Ms. Young should tell Dennis that she will have to ask her husband first because she already made plans with him, so it is really his call. | .257 | .966 | .066 |
| Items’ Measurement Errors Correlations | | | |
| | B7-A4 | .150 | |
| | F1-E7 | .209 | |
| | J6-E7 | -.155 | |
| | H6-G4 | .288 | |

Note: All loadings and correlations presented indicate statistically significant associations ($p < .05$).

4.5. Test of the Factor Structure of the TKI-HS “Consult” Strategy

In order to test the single-factor structure of the “consult” strategy, CFA was applied to data collected from the 11 items that, according to TKI-HS inventors, are comprised in the “consult” practical strategy.

The initial ME.1 (ME.1 model: M = Model, E = Consult) showed a marginally acceptable fit on CFI: [$\chi^2(44, N = 279) = 55.585, p = .113, \chi^2/df = 1.3, CFI = .935, SRMR = .047, RMSEA = .031$ (CI 90% .000 - .053)]. However, when the Wald Test modifications were included in the initial ME.1 model, the fit of the final ME.2 was improved on all indices, and especially on CFI: [$\chi^2(35, N = 279) = 43.204, p = .160, \chi^2/df = 1.23, CFI = .953, SRMR = .044, RMSEA = .029$ (CI 90% .000 - .055)] (CI 90% .014 - .067)] (see Brown, 2006; Hu & Bentler, 1999; Kline, 2005). The single-factor structure of the “consult” strategy that was finally confirmed, comprises 10 items, which are presented in Table 5.

Table 5. Model ME.2 for the structure of the 10-item version of the Greek TKI-HS “consult” strategy (standardized solution).

| Items | “Consult” strategy | E | R2 |
|---|--------------------|------|------|
| A2. Ms. Johnson should tell Robert that she will check out the policy on meeting with students out of school, and then she should ask other teachers what they would do in a similar situation. | .314 | .949 | .098 |
| B5. Mr. Brown should suggest a meeting with the mother, the daughter, and the principal. | .421 | .907 | .177 |
| C6. Mr. Miller should listen to the mother’s concerns and promise to get back to her once he consults with the principal and department chair. | .487 | .873 | .238 |
| D1. Ms. Wilson should ask Susan’s other teachers and guidance counselor about Susan’s performance on structured tests as compared with her projects and papers. | .354 | .935 | .125 |
| E3. Mr. Moore should speak with William’s other teachers to see if he is above average in other subjects and if this has led to more disruptive behavior. | .470 | .882 | .221 |
| F6. If Ms. Thomas is unable to gain control of her students, she should seek advice from a colleague or the principal after class. | .524 | .851 | .275 |
| G3. Mr. Jackson should talk to the department chair privately about his concerns. | .189 | .982 | .036 |
| H4. Ms. Martin should ask her department chair for advice | .354 | .935 | .125 |
| J5. Ms. Young should sit down with her husband, and the two of them should decide. | .218 | .976 | .048 |
| K6. Ms. King should share this information with the principal and ask for the principal’s advice. | .436 | .900 | .190 |

Note: All loadings presented indicate statistically significant associations ($p < 0.05$).

4.6. Test of the Factor Structure of the TKI-HS “Legislate” Strategy

In order to test the single-factor structure of the “legislate” strategy, CFA was applied to data collected from the 11 items that, according to TKI-HS inventors, are comprised in the “legislate” practical strategy.

The initial MF.1 (MF.1 model: M = Model, F = Legislate) model was not acceptable according to various indices of fit: [$\chi^2(44, N = 279) = 80.976, p = .001, \chi^2/df = 1.8, CFI = .561, SRMR = .064, RMSEA = .055$ (CI 90% .04 - .07)]. We considered the modifications indicated by the Wald and Lagrange Multiplier tests as well as the Residual analyses and included them in the final MF.2 model which achieved a fully acceptable fit on all indices: [$\chi^2(5, N = 279) = 4.398, p = .493, \chi^2/df = .90, CFI = 1.000, SRMR = .030, RMSEA = .000$ (CI 90% .000 - .078)] (see Brown, 2006; Hu & Bentler, 1999; Kline, 2005). The single-factor structure of the “legislate” strategy that was finally confirmed, comprises 5 items, which are presented in Table 6.

4.7. Test of the Factor Structure of the TKI-HS “Retaliate” Strategy

In order to test the single-factor structure of the “retaliate” strategy, CFA was applied to data collected from the 11 items that, according to TKI-HS inventors, are comprised in the “retaliate” practical strategy.

The initial MG.1 (MG.1 model: M = Model, G = Retaliate) model was not acceptable according to various indices of fit: [$\chi^2(44, N = 279) = 62.098, p = .037, \chi^2/df = 1.4, CFI = .752, SRMR = .053, RMSEA = .038$ (CI 90% .01 - .06)]. We proceeded with the inclusion of the modifications indicated by the Wald and Lagrange Multiplier tests as well as the Residual analyses into the final model MG.2 which achieved a better fit on all indices: [$\chi^2(14, N = 279) = 16.016, p = .312, \chi^2/df = 1.14, CFI = .961, SRMR = .040, RMSEA = .023$ (CI 90% .000 - .064)] (see Brown, 2006; Hu & Bentler, 1999; Kline, 2005). The single-factor structure of the “retaliate” strategy that was finally confirmed, comprises 7 items, which are presented in Table 7.

Table 6. Model MF.2 for the structure of the 5-item version of the Greek TKI-HS “legislate” strategy (standardized solution).

| Items | “Legislate” strategy | E | R ² |
|--|----------------------|------|----------------|
| B3. Mr. Brown should institute a set of rules that specify what the consequences of disruptive behavior will be (and what constitutes disruptive). | .598 | .801 | .358 |
| E4. Mr. Moore should go over his rules with the class, emphasizing the importance of respect. | .504 | .863 | .254 |
| H3. Ms. Martin should decide that from now on she will not take the principal’s criticisms seriously. | .217 | .976 | .047 |
| J3. Given the situation with her family, Ms. Young should make it a personal policy that she will not break any more | .250 | .968 | .063 |
| K7. Ms. King should make it her practice to intervene if she receives credible third-party information concerning serious risks to students. | .228 | .974 | .052 |

Note: All loadings presented indicate statistically significant associations ($p < .05$).

Table 7. Model MG.2 for the structure of the 7-item version of the Greek TKI-HS “retaliate” strategy.

| Items | “Retaliate” strategy | E | R2 |
|---|----------------------|------|------|
| B1. Mr. Brown should tell Patricia’s mother that if she doesn’t start to treat him with more respect, he is going to be obliged to hang up the phone. | .431 | .902 | .186 |
| C3. Mr. Miller should inform the mother that either her son learns the content with the rest of the children or he will fail him. | .224 | .975 | .050 |
| E1. Mr. Moore should tell William, in front of the class, that any further disruption will be punished. | .353 | .936 | .124 |
| F3. Ms. Thomas should try to get attention back by shouting or hitting on the table. | .414 | .910 | .172 |
| G7. Mr. Jackson should persuade his colleagues to oppose any extra assignments from the chair in the future. | .354 | .935 | .125 |
| H2. Ms. Martin should tell the principal that she will write a letter to the school board if he continues to treat her poorly. | .290 | .957 | .084 |
| J1. Ms. Young should tell Dennis that she can’t come tonight, but that there is no such thing as a good luck charm. | .247 | .969 | .61 |

Note: All loadings presented indicate statistically significant associations ($p < .05$).

4.8. Test of the Factor Structure of the Seven Types of TKI-HS Strategies

Exploratory factor analysis (EFA) was applied to all seven types of TKI-HS strategies in order for us to be able to identify the number of their organization’s underlying factors (Mulaik & Millsap, 2000). Because of the relatively small sample size, analyses were not run at the item level but at the total scores for the aforementioned verified factor structure of each type of TKI-HS strategies, namely: “avoid”, “comply”, “consult”, “confer”, “delegate”, “legislate”, and “retaliate”.

As regards the conduction of the exploratory factor analysis, we estimated the sampling adequacy through the Kaiser-Meyer-Olkin (K.M.O. = .510) and Bartlett’s test of sphericity Tests ($\chi^2 = 308.673$, $df = 21$, $p < .001$) and we also used the scree plot to determine the number of factors to retain in the analysis. For the factor extraction, we performed Principal Component Analysis (PCA) with Oblique factor rotation which yielded three factors with eigenvalues greater than 1.00. As no statistically significant correlation was found among the three factors, the exploratory factor analysis was repeated with Varimax rotation, which yielded three factors with eigenvalues greater than 1.00. All strategies had a rotated factor loading $> .50$ on to one of the three factors. Factor loadings are presented in **Table 8**.

The application of EFA revealed that the “avoid”, “delegate”, and “retaliate” strategies were loading onto the first factor that is labeled “indifference and avoidance”.

Table 8. Exploratory factor analysis (Varimax rotation) of the factor structure of the seven types of the Greek TKI-HS strategies.

| Strategies | Factors | | |
|---|---------|--------|--------|
| | F1 | F2 | F3 |
| “comply” | | | .866 |
| “consult” | | | .710 |
| “confer” | | .797 | |
| “legislate” | | .735 | |
| “avoid” | .694 | | |
| “delegate” | .785 | | |
| “retaliate” | .716 | | |
| Eigenvalue | 1.78 | 1.65 | 1.33 |
| Percentage of explained variance | 25.41% | 23.58% | 18.99% |
| Percentage of the total variance: 67.99% | | | |

The “confer” and “legislate” strategies were found to be loading onto the second factor that is labeled “active response”, while the “comply” and “consult” strategies were found to be loading onto the third factor that is labeled “passive attitude”.

4.9. The Effect of Teaching Experience on the Choice of the Seven Types of TKI-HS Strategies

Results of the one-way analysis of variance (ANOVA) and Tukey HSD tests conduction, demonstrated that teaching experience differentiates teachers only in their choice of the “comply” strategy regarding the management of situations arising in the school environment $F(3, 275) = 6.5, p = .000, \eta^2 = .26$. More specifically, teachers with less than five years of experience tended to choose more frequently ($M = 24.6, SD = 3.42$) the “comply” strategy in their interactions in workplace issues compared to their peers with 5 - 9 years of experience ($M = 21.6, SD = 3.48$), 10-14 years ($M = 20.8, SD = 3.52$) and 15 - 19 years ($M = 20.9, SD = 2.74$). The teaching experience was not found to differentiate teachers in their choice of the rest six TK strategies in their workplace interactions. This finding is consistent with Hypothesis H2a, which predicted a small effect of teaching experience on teachers’ choice of TK strategies.

5. Discussion

The main aim of the current study was to explore the factor structure of the Tacit Knowledge Inventory for High School Teachers (TKI-HS) in a Greek sample of secondary education (high school) teachers using CFA and EFA analyses. In specific, this study attempted to test the structure, proposed by the inventors (Stemler et al., 2006) of TKI-HS, who suggested that the 77 items of the 11 scenarios’ inventory are loading, per 11, on one of the seven types of practical

strategies, namely: “Avoid”, “Comply” “Consult”, “Confer”, “Delegate”, “Legislate” and “Retaliate”.

However, it should be noted that the best-fitting models that were provided of the CFA applied to examine the factor structure of the 11 items corresponding to the “confer”, “delegate”, and “consult” strategies, were found to comprise 10 of the 11 initial items of each strategy. Similarly, the best-fitting models that were provided of the CFA applied to examine the factor structure of the 11 items corresponding to the “avoid”, “comply” and “retaliate” strategies, were found to comprise 7 of the 11 initial items of each strategy. Finally, the best-fitting model that was provided of the CFA applied to examine the factor structure of the 11 items corresponding to the “legislate” strategy, was found to comprise 5 of the 11 initial items of each strategy.

In general, although CFA models verified a uni-factor structure for each of the seven strategies of the Greek version of TKI-HS inventory, it should be noted that this verified uni-factor structure—of each one of the seven strategies—was slightly different from the one suggested by the initial TKI-HS inventory designers. Therefore, the hypothesis 1a was partially confirmed.

In an effort to extend the aforementioned main aim, this study attempted using EFA an initial investigation of the broader factor structure of the seven types of Greek version of TKI-HS strategies. The application of EFA revealed a pattern of their organization into three broad factors/groups. The “avoid”, “delegate” and “retaliate” strategies were loading onto the first factor. The common attribute of these three strategies is that their use does not imply an immediate and active involvement in the problem encountered. On the contrary, the adoption of these strategies seems to intensify the problem as implies that the responsibility for resolving the problem is either delegated to another person, or the problem is overlooked, without any personal handling of the situation or any intention of improving it by those involved.

The “confer” and legislate” strategies were found to be loading onto the second factor. Their common attribute is that their use implies an active and immediate response to the problem that has arisen, by those involved. Finally, the “comply” and “consult” strategies were found to be loading onto the third factor. The adoption of any of these two strategies is characterized by the passive attitude of those involved in the problem that has arisen, including the adoption of any proposed solution.

As secondary objective of the current study it was considered the clarification of the role of teaching experience in respondents’ choice of TK strategies for their workplace interactions. The unique effect of teaching experience on teachers’ choice of TK strategies was found on the choice of the “comply” strategy. Novice teachers with less than 5 years of experience tended to choose the “comply” strategy more frequently than their experienced peers. It appears that limited teaching experience inhibits the availability of initiatives and enhances teachers’ need to adopt the suggestions and advice of their older and more experienced peers. This finding confirms Hypothesis 2a and reinforces the view that lack of expe-

rience leads teachers to rely on their peers at the beginning of their careers and largely seek their support (Bandura, 1997; Woolfolk Hoy & Burke-Spero, 2005).

The findings of this study are subject to certain limitations. One limitation is that in the study's sample there was a low representation of participating teachers with less than five years of teaching experience, compared to participating teachers with 5 - 15 years of teaching experience. This unequal representation might constrain the generalizability of the findings. Further research should extend this study to broader groups of in-service teachers: teachers with less than 5 years' experience as well as teachers with more than 20 years' experience.

Although the Greek version of the TKI-HS inventory constitutes an informative measure for the assessment of Greek secondary education teachers' tacit knowledge, one of the difficulties encountered concerns who should serve as experts. Thus, this study's experienced teacher group's perspectives may differ in many respects from perspectives that will emerge in other contexts and cultures or from the perspectives of professionals working in other regions. Future research should include groups of teachers from different cultures, not only Western, thereby helping in identify more clearly which courses of action are generally seen as sound or poor.

6. Conclusion

However, regardless of the above limitations, the contribution of the present study at a methodological level is the adaptation of a valid measure for the assessment of Greek high school teachers' tacit knowledge on the appropriate way to interact with people in their immediate and broader professional/working environment. The assessment of tacit knowledge may be one important step toward understanding the components of skilled teaching. The practical implications of the research findings concern their utilization in the training of prospective teachers or in the training of incumbent teachers, helping to create conditions that could help strengthen their beliefs of effectiveness, as well as increase enthusiasm and effort for teaching. Using the TKI-HS inventory to identify difficulties and weaknesses of secondary education teachers, especially for novices, can provide a platform for constructing intervention programs that promote teachers' capacities to manage their school interpersonal interactions and handle "demanding" situations that arise in their workplace. Therefore, the adaptation of such a tool can provide new opportunities for both research and professional practice.

Although more research is also needed to further validate and refine the Greek version of the Tacit Knowledge Inventory for High School Teachers and to replicate our current findings, the results of this study, with the size of the sample used, show that the Greek version of TKI-HS inventory is a useful and valid instrument for measuring tacit knowledge in the Greek cultural context and its existence can extend evolving cross-cultural endeavors on research undertaken by Sternberg and his colleagues as an attempt to assess and examine the nature and development of teachers' practical intelligence (Elliot et al., 2011; Stemler & Sternberg, 2006; Stemler et al., 2006; Sternberg et al., 2000).

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Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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