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PARTICIPATION IN ONLINE COOPERATIVE PROFESSIONAL DEVELOPMENT: FACTORS TO CONSIDER AND ACTIVITIES TO PRACTICE

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Abstract. This study deals with relevant components of a technology innovation framework suitable for the examination of online collaborative professional development. By using a sample of 55 lower-secondary mathematics teachers and 155 primary school teachers, this study examined the relationships among teachers' intention to participate in online collaborative professional development (OCPD), their perspective taking, and their computer self-concept. It was found that while this intention was positively related to computer self-concept, perspective taking could positively relate to this intention only indirectly through computer self-concept. It was also found that, among three OCPD activities used to describe the intention, the activity of cooperatively analyzing videos of lessons given was preferred least by all these teachers. Implications for research are also included.

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MSC Subject Classification: 97C60, 97D40

Key words and phrases: Computer self-concept; online collaborative professional development; perspective taking; technology innovation framework.

Introduction

There is an increasing interest in applying online collaborative professional development (e.g., [2]). Under the slogan "Collaboration and reflection are key to effective learning", Cambridge Assessment International Education, for example, offers this kind of development to support the teaching of Cambridge courses, including subjects English, Mathematics, and Science (see `https://www.cambridgeinternational.org/support-and-training-for-schools/training/`).

Research has shown that online collaborative professional development (OCPD) may in general be a valuable means to develop supportive and collegial teaching practices [15]. Considering mathematics education in particular, such a professional development may improve teachers' knowledge of the content they teach as well as of pedagogy applied in doing that (e.g., [18]).

What theoretical framework may be used to study OCPD?

A framework for user participation in online communities is lacking (e.g., [16]). On the other hand, there are useful technology innovation models, such as TPB – Theory of Planned Behavior and UTAUT – Unified Theory of Acceptance and Use of Technology (see [23] for such models), which postulate that a subject's intention to participate in technology-based activities influences his/her actual participation in those activities. However, as collaborative rather than individual experiences are now relevant, this intention is possibly influenced by other factors not included in these models.

Apart from the collaborator's intention, his/her professional gains (learning achievement) in OCPD also need to be examined within a suitable framework. Researcher may use TPCK (Technological Pedagogical Content Knowledge) framework as proposed by Niess [17]. Although this framework takes into account the role of the context in which learning occurs, factors that may influence the acquisition of this specific knowledge and its constituent knowledge types are not indicated. Note that the TPCK framework may be combined with the instrumental orchestration model [5].

A technology innovation framework suitable for the examination of OCPD is clearly lacking. It is true that several frameworks proposed by researchers in mathematics education have been (could be) applied to examine teacher work and learning through collaboration, but this examination needs more empirical investigations concerning particular aspects of such professional development [19], which would help researchers to refine those frameworks or develop new ones. To this end, certain components of a suitable OCPD framework need to be measured appropriately and their influence on that work and learning studied thoroughly. To contribute to this complex task, the study reported in this paper deals with identifying relevant components of such a framework.

What factors influencing OCPD may be considered?

In teacher collaboration, professional learning develops through the negotiation of meaning (e.g., [8]), often involving the resolution of opposing arguments (e.g., [22]; cf. "critical alignment" in [7]). To understand this learning and its outcome, researcher may thus consider the collaborator's perspective taking [4], i.e. his/her ability to recognize other people's perspective, which could positively influence group discussion (e.g., [11]). To understand this learning and its outcome when OCPD is applied, researcher may also consider the collaborator's computer-self concept, i.e. his/her self-perceived competence in using computers. Such a self-concept might positively influence his/her computer-related performance (e.g., [3]).

To determine the relevance of these two factors, this study examined them by using the following research question: "Might a teacher's intention to participate in OCPD be related to his/her perspective taking and computer self-concept?" As OCPD includes several activities (e.g., collaborative lesson preparation), this study also examined which of the OCPD activities considered might be preferred least by teachers.

These research questions were answered for two groups of teachers: primary school teachers and mathematics teachers in lower secondary education. The primary school teachers were teachers with a degree in primary education, teaching mathematics to grades 1-4 along with other school subjects (except for foreign language). The mathematics teachers were teachers with a degree in mathematics, teaching mathematics to grades 5-8. It was hoped that, by using these contrasting groups of teachers, some global patterns, if any, might be discovered.

Method

Sample

This study used a convenience sample of 210 teachers from primary and lower secondary schools in Belgrade: 55 mathematics teachers (subject teachers) and 155 primary teachers (class teachers). Details about these teachers with respect to gender and the highest degree obtained are given in Table 1. Note that the initial sample comprised 60 mathematics teachers and 160 primary teachers, but only teachers with complete data on the main variables used in this study were included.

Table 1: Gender and degree of participants

Background variable	Subject teachers	Class teachers
1. Gender		
female	43 (78%)	136 (88%)
male	10 (18%)	12 (8%)
missing	2 (4%)	7 (5%)#
2. Degree		
associate	4 (7%)	20 (13%)
bachelor	43 (78%)	86 (55%)
master	8 (15%)	38 (25%)
missing	/	11 (7%)

Due to rounding, this total is not equal to 100

Design and variables

This study utilized a correlative design involving four variables. One background variable was Teaching Experience (TE). Three main variables were Online Cooperative Professional Development (OCPD), Perspective Taking (PT), and Computer Self-Concept (CSC). To compare OCPD activities in terms of application frequency, the study also used a comparative descriptive design.

Instrument and procedure

The instruments applied asked participants to answer 12 questions regarding their gender, highest degree obtained, and the four variables used in this study.

TE was measured in years of in-service teaching (e.g., 15 years) indicated by each study participant.

OCPD was measured by a 5-point Likert scale administered with the following three statements: "Preparing cooperatively materials for students' classroom work", "Analyzing cooperatively videos of lessons given", and "Developing cooperatively tests for assessing students' knowledge." The five points were: 1-none, 2-rarely, 3-occasionally, 4-often, and 5-very often. For each statement, participants indicated the extent to which they would use the activity in question in a group online professional development based upon particular educational standards. While the primary teachers considered these statements in general, the secondary school mathematics teachers responded to them having in mind their subject teaching.

PT was measured by a 5-point Likert scale administered with the following three statements: "I sometimes find it difficult to see things from other person's perspective", "In case of disagreement, I try to look at opposing opinions before I take my own stance", "If I'm sure I'm right about something, I don't waste much time listening to other people's arguments." These statements, as the most relevant to the context of this study, were taken from a 7-item perspective taking scale proposed by Davis [4] and slightly modified for this context. For each statement, participants indicated the extent to which they agree with it. A scale ranging from 1-strongly disagree to 5-strongly agree was used, and scoring were reversed for the first and third statements.

CSC was measured by a 5-point Likert scale administered with the following three statements: "I rarely encounter problems when working on computer", "I quickly learn how to use a new computer program", "Everything about computers is not one of my strengths." These statements were adopted from a self-confidence in mathematics scale used in TIMSS studies (e.g., see items 16a, 16c, and 16d in the TIMSS 2011 grade 8 student questionnaire available at `https://timssandpirls.bc.edu/timss2011/downloads/T11_StuQ_8.pdf`). For each statement, participants indicated the extent to which they agree with it. A scale ranging from 1-strongly disagree to 5-strongly agree was used, and scoring were reversed for the third statement.

The instrument was initially administered during the second semester of the 2018/19 school year in twelve schools in different parts of the city. Because in each school, the number of class teachers was on average 4–5 times greater than that of subject teachers, the instrument was additionally administered in few other schools and among participants in professional development of mathematics teachers, to have a larger sample of mathematics teachers (with, in total, participants from about 25 schools; usually 1–3 teachers per school).

Data transformation and statistical analysis

Because of low reliability of some of the applied measures, the participants' responses, previously expressed by corresponding numbers, were transformed into Guttman's [9] image form scores (as, for example, done in [13]). For each main variable (OCPD, PT, and CSC), the participant's answers were represented by the average of the corresponding transformed scores. Apart from correlative analysis, t-tests for paired samples were applied.

Results

Tables 2 and 3 summarize the reliability of the measured variables, the means and standard deviations of these variables, and Pearson's correlations among them[1]. Table 2 refers to the data regarding the subject teachers (Nst = 55), whereas Table 3 refers to the data regarding the class teachers (Nct = 155). For both groups of teachers, OCPD and CSC were correlated, OCPD and PT were not correlated, and PT and CSC were correlated, meaning that PT could positively relate to OCPD only indirectly through CSC. Partial correlation between OCPD and CSC, controlling for PT and TE, was positive and significant for the subject teachers (0.362, $df = 49$, $p = 0.009$) and zero for the class teachers (0.104, $df = 144$, $p = 0.213$).[2] In other words, while PT and TE could not influence the relationship between OCPD and CSC for the subject teachers, they did so for the class teachers.

Table 2: Descriptive statistics and correlations for subject teachers

Variable	α / M (SD)		Correlation+	
		2.	3.	4.
1. TE#	NA / 18 (10)	−0.175	−0.162	−0.375**
2. OCPD	0.88 / 3.3 (0.72)		0.062	0.368**
3. PT	0.82 / 3.4 (0.56)			0.513**
4. CSC	0.97 / 4.0 (0.91)			

Nst = 55 + Nst = 53 $**p < 0.01$

Table 3: Descriptive statistics and correlations for class teachers

Variable	α / M (SD)		Correlation+	
		2.	3.	4.
1. TE#	NA / 20 (10)	−0.173*	−0.301*	−0.502**
2. OCPD	0.94 / 3.5 (0.84)		0.018	0.167*
3. PT	0.79 / 3.3 (0.70)			0.310**
4. CSC	0.94 / 3.7 (0.87)			

Nst = 155 + Nst = 148 $*p < 0.05$ $**p < 0.01$

[1] As it occurs often, the assumption of normality was violated. Because of that, the data of all variables were normalized for both groups of teachers, by using the Rankit proportion estimation formula. Then, by using a web-tool available at `http://www.biosoft.hacettepe.edu.tr/MVN/` [14], the outliers were detected and removed, and the assumption of multivariate normality was tested. As this assumption was not violated, Pearson's correlations in question were determined for the remaining normalized data.

[2] Spearman's partial correlations were 0.297 ($df = 49$, $p = 0.034$) and 0.137 ($df = 144$, $p = 0.100$), respectively. When all guttmanized (raw not normalized) data were used, this correlation was positive and significant at a 0.05 level for both groups of teachers (the subject teachers: 0.277, $df = 51$, $p = 0.045$; the class teachers: 0.175, $df = 151$, $p = 0.031$).

For both kind of teachers, a high reliability of OCPD, along with high correlations of the three OCPD indicators with OCPD (at least 0.90 for the subject teachers; at least 0.83 for the class teachers), resulted in a solid reliability of individual OCPD indicators, especially for the subject teachers (the formula for correction for attenuation [25] was applied), which supported the application of paired samples t-tests to find out which of the three activities might be preferred least. For both kinds of teachers, this activity was "Analyzing cooperatively videos of lessons given" (the subject teachers: 2.6 vs. 3.5 and 3.6 for other activities; t in comparisons > 12.00, $df = 54$, $p = 0.00$; the class teachers: 3.1 vs. 3.6 and 3.7; $t > 13.00$, $df = 154$, $p = 0.00$).[3]

Discussion

Two important findings, relevant to both kinds of teacher, emerged from this study. Firstly, while there was a significant correlation between CSC and PT, it was just CSC that was significantly correlated with OCPD, and both correlations were positive. Secondly, the activity in OCPD the teachers preferred least was that of cooperatively analyzing videos of lessons given. The following paragraphs examine these findings in more detail.

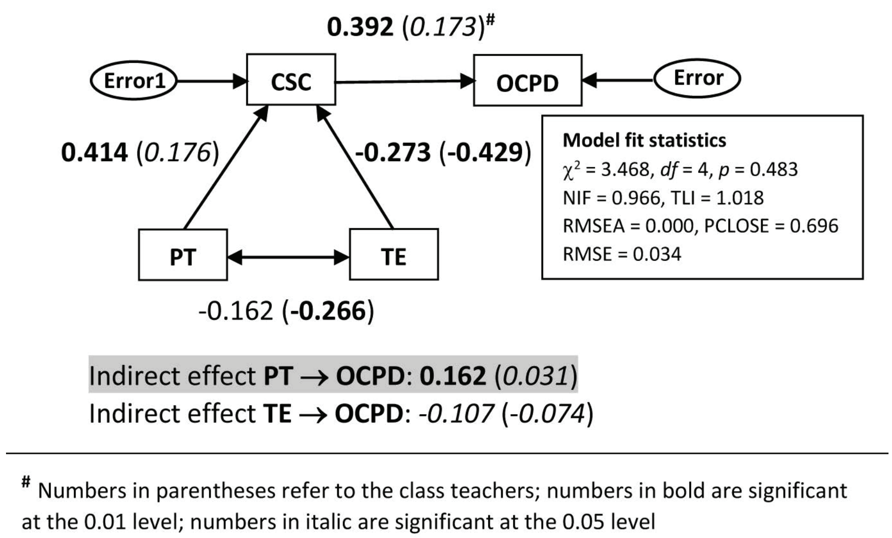

Figure 1. A path analysis model and its fit statistics

The main research question was "Might a teacher's intention to participate in OCPD be related to his/her perspective taking and computer self-concept?"

[3] Although the assumption of normality was violated, both parametric and non-parametric tests applied to all guttmanized (raw not normalized) data, as well as to the remaining such data when the outliers were removed, yielded an identical outcome for both groups of teachers.

This intention was positively related to computer self-concept, and although perspective taking was not related to intention directly, it could positively relate to this intention only indirectly through computer self-concept, which was supported by additional path analyses where the indirect effect in question was indeed positive and significant (see Fig. 1). Such a mediating role of computer self-concept (the so-called indirect-only mediation [26]) has to the author's knowledge, not been reported in the literature (cf. [20], where self-concept of computer mediated the relationship between gender and intention to pursue ICT-studies). However, research has provided evidence of the positive influence of computer self-concept on computer-based activities (e.g., [3]). Furthermore, as mentioned above, research has provided evidence of the positive influence of perspective taking on collaborative work, such as that higher-levels of perspective taking result in higher-levels of group discussion [11]. Although perspective taking and computer self-concept may influence individual professional gains, to explain such gains for a group of collaborators the degree of agreement of their perspective taking and computer self-concept may also be taken into account (for such an approach, see [12]).

This study considered three OCPD activities, including cooperatively analyzing videos of lessons given, which may be highly valued by teachers [1]. Surprisingly, this activity was preferred least by the participants in the study, probably because contrary to two other activities, the activity has rarely (or not at all) been practiced in teacher education in Serbia. Although video analyzing may indeed be a powerful means to recognize different teaching practices and improve them (e.g., [10]), before it becomes such a means, a number of didactic issues need to be addressed appropriately, such as identifying and interpreting relevant classroom events, articulating different objectives of video analyzing, and using this analyzing as a routine practice in teacher professional development [6]. In doing that, a documentational genesis perspective may be applied [24].

Closing remarks

This study found that while teachers' intention to participate in online collaborative professional development was positively related to computer self-concept, their perspective taking could be positively related to this intention only indirectly through computer self-concept. As the two groups of teachers did not differ with respect to these relations, in developing a framework for studying online collaborative professional development, research might focus on critical variables influencing teachers' intention to participate in this development and their achievement in doing so, including, among other factors, the constructs of perspective taking and computer self-concept examined in this paper. Furthermore, to study the influence of these and other relevant constructs on teacher work and learning through online collaboration, apart from correlation analysis, researchers may apply path analysis (see Fig. 1), which determine indirect and direct effects among several independent and dependent variables simultaneously [21].

Another finding that emerged from this study was that the activity of cooperatively analyzing videos of lessons given was preferred least by both groups of teachers, which, as mentioned above, was probably caused by the fact that this activity, contrary to two others considered, has rarely (or not at all) been practiced in teacher education in Serbia. Bearing in mind the great potential of this activity to improve the quality of teaching, further research may focus on factors enabling its successful implementation and wider integration in traditional and online collaborative professional development.

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