

MATHEMATICS TEACHERS' PROFESSIONAL DEVELOPMENT – GENDER DIFFERENCE

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Abstract

As professionals, teachers need to invest into their professional development on a long-term basis in order to fulfil the job demands across their entire career. Additional insight into this issue can be obtained by exploring how teachers perceive their professional development. Therefore, the aim of this paper is to examine gender differences related to participation in various professional development activities, perceived impact of professional development, support for and obstacles to professional development, as well as, the need for professional development. Data was collected within the 2013 Teaching and Learning International Survey (TALIS 2013) on a sample of 440 Serbian mathematics teachers (ISCED 2) from 191 schools (65.7% female and 34.3% male teachers). A standardized TALIS questionnaire for teachers was used for data collection. The results show that more female teachers participated in at least one professional development activity during the previous 12-month period (93.1% vs. 86.2%, $\chi^2(1,444) = 5.559$, $p < .05$) than their male colleagues. A similar number of female and male teachers attended various types of professional development activities (such as workshops, observation visits to other schools, in-service training courses, participation in teachers' networks, collaborative research, peer observation, etc.), except education conferences which were attended by more female teachers (63.4% vs. 48.1%, $\chi^2(1,444) = 9.795$, $p < .01$). Additionally, female teachers spend more days in professional development activities in general (27 vs. 17 days). Furthermore, female teachers expressed a higher need for professional development than their male colleagues, especially in teaching students with special needs (68.1% vs. 58%, $\chi^2(1,435) = 4.358$, $p < .01$), new technologies in the workplace (54.9% vs. 45.6%, $\chi^2(1,437) = 3.346$, $p < .05$), approaches to individualised learning (48.8% vs. 39.7%, $\chi^2(1,438) = 3.263$, $p < .05$), teaching cross-curricular skills (46.7% vs. 32.1%, $\chi^2(1,437) = 7.959$, $p < .01$) and student behaviour and classroom management (45.8% vs. 31.3%, $\chi^2(1,438) = 8.581$, $p < .01$). Male teachers more often highlighted a lack of employer support as a barrier to participation in professional development (38.3% vs. 28.6%, $\chi^2(1,439) = 4.206$, $p < .05$). There is no deference between female and male teachers regarding their perception of professional development activities' impact and costs, as well as, the support obtained by the school. Based on the results it can be concluded that female mathematics teachers invest more in their professional development and they are more sensitive to development of competences that directly support teaching and learning.

Keywords: *Teachers, mathematics, professional development, gender difference, TALIS 2013.*

1. Introduction

TALIS - the OECD Teaching and Learning International Survey examines both the conditions under which learning takes place and under which teachers work. TALIS examines the ways in which teachers' work is recognised, appraised and rewarded and assesses the degree to which teachers perceive that their professional development needs are being met. The study provides insights into the beliefs and attitudes about teaching that teachers bring to the classroom and the pedagogical practices that they adopt. Additionally, TALIS examines the extent to which certain factors relate to teachers' reports of job satisfaction and self-efficacy. Finally, recognising the important role of school leadership, TALIS examines the roles of school leaders and the support that they give their teachers (OECD, 2009, 2014).

The TALIS survey focuses on the following policy issues: (1) The appraisal of teachers' work in schools and the form and nature of the feedback they receive, as well as the use of outcomes from these processes to reward and develop teachers; (2) The amount and type of professional development available to teachers and their needs and barriers for accessing training; (3) The impact that school-level policies and practices, including those of the school leadership, shape the learning environment in schools and

impact the work of teachers; (4) The creation and support of effective school leadership in an era of accountability and devolution of educational authority; (5) The extent to which recent trends in school leadership and management have an impact on teachers; (6) The profiles of countries with regard to teaching practices, activities, professional development needs, beliefs and attitudes, and variation in these according to teachers' background characteristics (OECD, 2009, 2013).

Research conducted over the past two decades (e.g., Darling-Hammond, 1999; Hargreaves, 2002; Hattie, 2009; Johnson, Kraft & Papay, 2012; OECD, 2009, 2014), unambiguously shows that professional development of teachers is one of the key factors both for improving the educational achievements of students and for greater teachers' work commitment.

Most scholars, regardless of their theoretical orientation (e.g., Desimone, 2009; Guskey, 2002 and 2009; Fessler, 1995; Tickle, 2000), when talking about the professional development of teachers, point to three phases - the phase of initial education (pre-service training), the introduction to work (induction phase) and the phase of continuous professional development (in-service training). The initial teacher education represents a formal preparation of teachers during which basic teaching competences are acquired. The induction phase is a stage when, with the support of mentors, real first independent steps into the role of teachers are made, i.e. when, for the first time, teaching is carried out independently. It is also a phase in which a novice teacher faces the professional reality. The phase of continuous professional development is the phase in which a teacher overcomes initial challenges and continues to work on improving their competences.

Different definitions of professional development can be found in the relevant literature. According to the definition used in TALIS, professional development of teachers includes activities that develop individual skills, knowledge, expertise and other characteristics of teachers in order to improve their teaching practice (OECD, 2013).

2. Objectives

As professionals, teachers need to invest into their professional development on a long-term basis in order to fulfil the job demands across their entire career. Additional insight into this issue can be obtained by exploring how teachers perceive their professional development. Therefore, the aim of this paper is to examine mathematics teachers' gender differences related to continuous professional development. The following elements were investigated: participation in various professional development activities, perceived impact of attended professional development activities, need for further professional development, as well as, support for and obstacles to professional development (OECD, 2014).

Mathematics teachers were selected for several reasons. Firstly, mathematics is not a favourite school subject for Serbian students. Only 15.6% of elementary school students like mathematics and 38.4% think that mathematics is useful subject (Petrović, 2000). In general, mathematics has been shown to be related with less interest and enjoyment than other domains, eliciting most anxiety among students (OECD, 2010; Radišić, Videnović & Baucal, 2015). Secondly, Serbian students underachieve in mathematics. For example, data collected in PISA 2012 survey show that students from Serbia on average have significantly lower performance in mathematics literacy (449 points, which is about 45 points lower average performance) compared to OECD countries. This difference corresponds roughly to the effects of 1 year of schooling (Pavlović, Babić & Baucal, 2013). Finally, Serbian mathematics teacher expresses a traditional set of beliefs about teaching and learning to a higher extent than teachers from other domains (e.g., Serbian language teachers) (Radišić & Baucal, 2012).

3. Methods

Data was collected within the Teaching and Learning International Survey (TALIS 2013) on a sample of 440 Serbian mathematics teachers (ISCED 2) from 191 schools (65.7% female and 34.3% male teachers).

The conducted research is non-experimental, survey type. A standardized TALIS questionnaire for teachers, developed by an international expert group, was used for data collection (OECD, 2013). The team of domestic experts in the field of education adapted the questions in the questionnaire (to the extent that it was possible) to the Serbian education system, and some issues that are of particular importance to Serbian educational context have been added. Questions in the questionnaire (there are 48 in total) are closed type, with two or more offered answers (e.g. Likert scales). Prior to use in the main research, the questionnaire was standardized and psychometrically validated in a pilot study involving 332 teachers from Serbia. Descriptive statistics were used for data processing, and one-factor analysis of the variance and the hi-square test was used to test differences between categorical and numerical variables.

4. Results

The results show that more female teachers participated in at least one professional development activity during the previous 12-month period (93.1% vs. 86.2%, $\chi^2(1,444) = 5.559$, $p < .05$). As shown in Table 1, a similar number of female and male teachers attended various types of professional development activities (such as workshops, observation visits to other schools, in-service training courses, participation in teachers' networks, collaborative research, peer observation, etc.), except education conferences which were attended by more female teachers (63.4% vs. 48.1%, $\chi^2(1,444) = 9.795$, $p < .01$). There is no significant difference between female and male teachers regarding the duration of particular professional activities. However, female teachers in general spend more days in professional development activities (27 vs. 17 days) than their male colleagues (see Table 1).

Table 1. Teachers' professional development activities during the previous 12 month period.

Type of professional development activities	Participation			Duration in days		
	Female	Male	Σ	Female	Male	Σ
Courses/workshops	71%	63%	67%	7	5	6
Education conferences or seminars	63.8%**	48.1%**	55.9%	7	5	6
Observation visits to other schools	10.3%	13.6%	11.9%	6	2	4
Observation visits to business premises, public organisations, NGOs	3.4%	6.5 %	4.9%	5	2	3.5
In-service training courses in business premises, public organisations, NGOs	7.9%	7.8%	7.9%	2	3	2.5
Qualification programme	28%	31.2%	29.6%	/	/	/
Participation in a network of teacher	28%	31.2%	29.6%	/	/	/
Individual or collaborative research on a topic of interest to you professionally	24.6%	28.1%	26.4%	/	/	/
Mentoring and/or peer observation and coaching	23.9%	29.2%	26.5%	/	/	/

Note. ** $p < .01$, * $p < .05$

Analyses of chosen areas of professional development (see Table 2) show that majority of teachers attained professional development activities related to student evaluation and assessment practice (78.2%) or to their discipline, such as, knowledge and understanding of a subject field (77.1%) and pedagogical competencies in teaching a subject field (67.9%). The lowest interest teachers show for school management and administration (10.1%), approaches to developing cross-occupational competencies for future work or future studies (8.5%) and teaching in a multicultural or multilingual setting (6.1%). Differences in a chosen area of professional development, among male and female teachers (in favour of male teachers), are obtained for knowledge of the curriculum (38.5% vs. 27.6%, $\chi^2(1,319)=3.971$, $p < .05$), ICT skills for teaching (57.8% vs. 40.0%, $\chi^2(1,318) = 6.344$, $p < .01$) and new technologies in the workplace (38.9% vs. 25.2%, $\chi^2(1,319) = 9.148$, $p < .01$)

Mathematics teachers expressed the highest need for professional development in the following areas (see Table 3): teaching students with special needs (63%), new technologies in the workplace (50%), approaches to individualised learning (44.3%) and ICT skills for teaching (44%). Regarding gender differences, female teachers expressed a higher need for professional development than their male colleagues, especially in teaching students with special needs (68.1% vs. 58%, $\chi^2(1,435) = 4.358$, $p < .01$), new technologies in the workplace (54.9% vs. 45.6%, $\chi^2(1,437) = 3.346$, $p < .05$), approaches to individualised learning (48.8% vs. 39.7%, $\chi^2(1,438) = 3.263$, $p < .05$), teaching cross-curricular skills (46.7% vs. 32.1%, $\chi^2(1,437) = 7.959$, $p < .01$) and student behaviour and classroom management (45.8% vs. 31.3%, $\chi^2(1,438) = 8.581$, $p < .01$). The lowest need for professional development teachers have for school management and administration (27.3%) and knowledge and understanding of subject (19.3%).

Regarding barriers to participation in professional development, the only significant gender difference is that female teachers perceive lack of employer support as a more important problem (38.3% vs. 28.6%, $\chi^2(1,439) = 4.206$, $p < .05$). For both female and male teachers, the main obstacles for professional development are expensiveness of professional development activities and a lack of incentives for participating in such activities (see Figure 1).

Table 2. Chosen areas of professional development during the previous 12 month period.

The areas of professional development	Female teachers	Male teachers	Σ
Student evaluation and assessment practices	74.8%	81.7%	78.2%
Knowledge and understanding of my subject field(s)	75.2%	78.9%	77.1%
Pedagogical competencies in teaching my subject field(s)	65.2%	70.6%	67.9%
ICT (information and communication technology) skills for teaching	40.0%**	57.8%**	48.9%
Approaches to individualised learning	46.2%	50.0%	48.1%
Student behaviour and classroom management	43.8%	48.1%	46%
Teaching students with special needs	32.5%	35.2%	33.9%
Teaching cross-curricular skills (e.g. problem solving)	32.9%	34.3%	33.6%
Knowledge of the curriculum	27.6%*	38.5%*	33.1%
New technologies in the workplace	25.2%**	38.9%**	32%
Student career guidance and counselling	24.3%	27.8%	26.1%
School management and administration	10.0%	10.2%	10.1%
Approaches to developing cross-occupational competencies	7.7%	9.3%	8.5%
Teaching in a multicultural or multilingual setting	6.7%	5.6%	6.1%

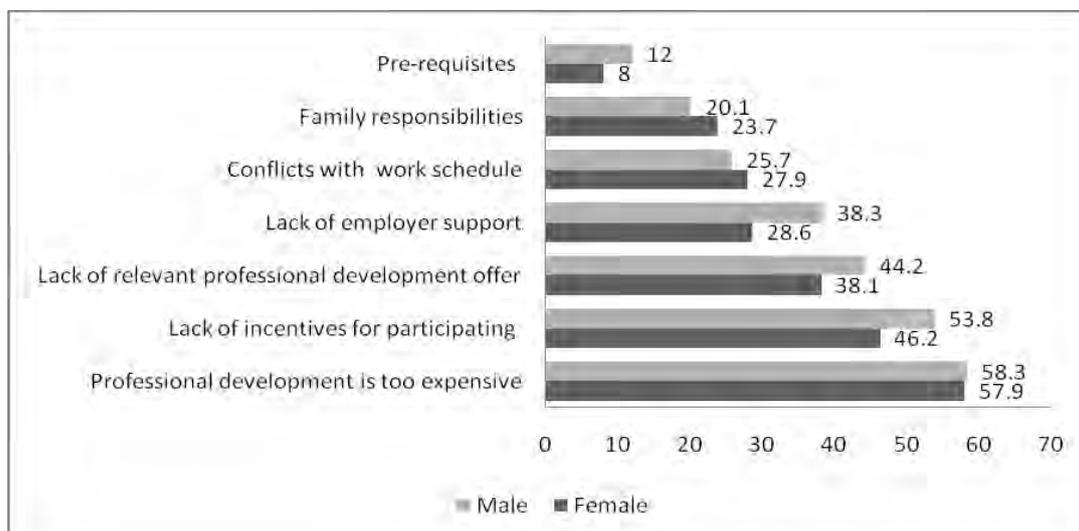
Note. ** $p < .01$, * $p < .05$

Table 3. High level of need for professional development.

The areas of professional development	Female teachers	Male teachers	Σ
Teaching students with special needs	68.1%*	58.0%*	63%
New technologies in the workplace	54.9%*	45.6%*	50%
Approaches to individualised learning	48.8%*	39.7%*	44.3%
ICT (information and communication technology) skills for teaching	47.9%	40.0%	44%
Approaches to developing cross-occupational competencies	45.9%	37.1%	41.5%
Teaching cross-curricular skills (e.g. problem solving)	46.7%*	32.1%*	39.4%
Student behaviour and classroom management	45.8%**	31.3%**	38.5%
Student evaluation and assessment practice	36.3%	34.0%	35.1%
Knowledge of the curriculum	32.9%	32.0%	32.5%
Pedagogical competencies in teaching my subject field(s)	31.5%	33.1%	31.7%
Teaching in a multicultural or multilingual setting	29.1%	32.0%	30.5%
School management and administration	27.7%	26.8%	27.3%
Knowledge and understanding of my subject field(s)	19.4%	19.1%	19.3%

Note. ** $p < .01$, * $p < .05$

Figure 1. Barriers to participation in professional development (%).



5. Discussion and conclusion

Compared to other Serbian teachers (see Petrović, Kuzmanović, Jošić, Jovanović, 2015), mathematics teachers attended more a qualification programme (e.g. a degree programme) and chose, to a larger extent, areas of professional development closely related to their subject field, such as knowledge of a subject field and pedagogical competencies in teaching a subject field. On the other hand, female mathematics teachers expressed a higher need for professional development related to teaching students with special needs, approaches to individualised learning and new technologies in the workplace than male teachers, and in that way, female mathematics teachers are more similar to other Serbian teachers. Based on the results, it can be concluded that female mathematics teachers invest more in their professional development and they are more sensitive to development of competences that directly support teaching and learning. Furthermore, the results obtained in this survey show that the priority of educational policy in Serbia, in terms of professional development of teachers, should be directed towards providing conditions for acquiring competencies for inclusive education and for the application of ICT and modern teaching technologies. Additionally, in order to provide greater coverage and greater participation of teachers from Serbia in continuous professional development it is necessary to increase the offer of professional development activities which are less expensive or free of charge, and to use additional incentives to stimulate teachers to participate in professional development activities (e.g. adapting the school schedule, gaining free days for professional development at the expense of additional engagement in teaching and extracurricular activities, increase of teachers' salaries, etc.).

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