PHYSICAL EDUCATION TEACHERS' SUBJECTIVE THEORIES ABOUT INTEGRATING INFORMATION AND COMMUNICATION TECHNOLOGY (ICT) INTO PHYSICAL EDUCATION

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ABSTRACT
As well as other school subjects, physical education (PE) is emerging in terms of integrating information and communication technology (ICT) into regular classes. Such innovative teaching practices that implement ICT in PE involve diverse parties that are affected by these teaching processes. Students, principals, districts, parents, administrators, policy makers, and last but least the PE teachers themselves are involved. Hence, each participating party has its own personal perceptions and attitudes towards ICT and PE. This study examined the subjective theories of PE teachers about integrating ICT into PE. PE teachers' subjective theories that feature the following areas were covered: 1) student, 2) teaching, 3) teacher, 4) equipment, 5) computer literacy, 6) classroom management and organization, 7) social interaction, and 8) innovative and modern teaching. Within the framework of the research program "subjective theories" (RPST), PE teachers' subjective theories were modeled into a questionnaire after being extracted from an expert group discussion. A total of 57 in-service secondary school PE teachers were surveyed using the developed instrument. The data was analyzed using standard statistical procedures. The analysis focused on the subjective theories themselves and their relation to gender, computer literacy, household computer ownership, and professional experience (years in service).

Keywords: Educational Technology, Information Technology, Physical Education, Physical Education Teachers, Subjective Theories, Technology Uses in Education, Teachers Attitudes, Technology Integration

INTRODUCTION
Information and communication technology (ICT) is widely seen as a motor of fostering 21st century skills in nearly all education-related fields, especially schools (Rutkowski, Rutkowski, & Sparks, 2011; Vockley, 2007). ICT has not only become ubiquitous in todays' children's and adolescents' daily lives, it has even been adopted by nearly all school subjects in the meantime – at least within academic discussion and debate (Webb & Cox, 2004). School students are surely so-called "digital natives" (Prensky, 2001), being used to deal with ICT as part of their lifestyle and even expecting it to serve as a surrounding resource throughout their educational and professional career (Prensky, 2008).

Among the school subjects, physical education (PE) has picked up the discussion of technology integration in the modern classroom as well (Kretschmann, 2010). Various teaching hints and pedagogical scenarios have been suggested to give physical education teachers valuable options for integrating technology into PE (Castelli & Fiorentino, 2008; Kretschmann, 2010; Mohnsen, 2012; Whalen & Fiorentino, 2006). The scope of instructional technology in PE ranges from computers, laptops, and tablets (Juniu, 2011; Leight, 2012), physical activity measurement devices (McCaughtry, Oliver, Dillon, & Martin, 2008) to online activities (Martin, Balderson, & Morris, 2012; McNeill, Mukherjee, & Singh, 2010) and active video gaming (Ennis, 2013). On the higher education level, physical education teacher education (PETE) programs have been in the discussion about ICT ever since (Leight & Nichols, 2012).

However, empirical research and evidence in the field of ICT, PE, and PETE is still rare and limited (Kretschmann, 2010). Although pre-service PE teachers and PE students have been in the focus of several studies (Adamakis & Zounhia, 2013; Goktas, 2012; D. L. Jones & Garrahy, 2001; Zorba, 2012), only a few studies emphasized the PE teachers' perspective (Gibbone, Rukavina, & Silverman, 2010; Gibbone & Silverman, 2010; Ince, Goodway, Ward, & Lee, 2006; Kretschmann, 2012), though mainly highlighting the PE teachers' ICT competence level (Liang, Walls, Hicks, Clayton, & Yang, 2006; Lockyer & Patterson, 2007; Thomas & Stratton, 2006; Woods, Goc Karp, Miao, & Perlman, 2008; C. Yaman, 2008; M. Yaman, 2007b).

Hence, the aim of this study was to determine what in-service and established PE teachers think about integrating ICTs into their respective PE classes. The main objective was to assess PE teachers' beliefs, opinions, views, perceptions, and attitudes towards technology integration in PE.

According to prior research findings, technology use in the educational settings is largely affected by the teachers' attitudes towards technology use (Albirini, 2006; Baylor & Ritchie, 2002). Teachers' attitudes appear

as a major predictor of the use of ICT in the educational fields (Albirini, 2006). Therefore, use of ICT in the classroom largely depends on the attitudes of teachers towards technology (Teo, 2008).

To integrate the diverse constructs involved in investigating the PE teachers' perspective, a "subjective theory" scientific framework was selected (Groeben & Scheele, 2000; Müller, Rebmann, & Liebsch, 2008), as the implicit thinking of PE teachers should be revealed. This approach tackles the personal and "subjective" PE teachers' point of view, which can also be called "epistemological beliefs" (Hofer, 2000).

"Epistemological beliefs are, therefore, always personal and consequently also subjective. This raises the question of the connection with subjective theories. Subjective theories can be considered as a person s set of assumptions, motives, suppositions, ideas and cognitions related to his view of himself and the world" (Müller et al., 2008, p. 91).

Blending the scientific framework with the initial study objective, the final study aim can be phrased: The main study objective is to determine the subjective theories of PE teachers about integrating ICT into PE. In a more colloquial formulization: "What do PE teachers think about integrating ICT in PE?"

METHODS AND METHODOLOGY

In order to prepare properly for the field of PE teaching reality, a two-phase research design based on the subjective theory framework was chosen. In the first phase, a group discussion among diverse experts of PE was performed to extract and quantify subjective theories from PE teachers about ICT in PE. In the second phase, the revealed subjective theories from phase one were modeled in a questionnaire to reach a higher amount of PE teachers.

Research Program "Subjective Theories"

The Research Program "Subjective Theories" (RPST) has had a rich impact on clinical and higher education research in Germany (Hermes, 1999; Wagner, 2003). In addition, RPST approaches have been applied to both PE and sports pedagogy research (Casella, 2012; König, 2013; Ommundsen, 2001).

RPST highlights the reflective abilities of the individual in explaining and conducting its own actions. From a metacognitive research perspective, the cognitive phenomenon of intuitive, "naïve", implicit theories about a respective topic or action serves as the starting point of scientific investigation. Explanation, prediction, and application of knowledge can be extracted out of the research subject's verbalized or written thinking, analogue to scientific theories. A subjective theory therefore is a complex cognitive aggregate of the research object by the research subject (Groeben & Scheele, 2000).

Although the majority of studies used qualitative-only approaches, only few studies combined both qualitative and quantitative methods (Richardson & Placier, 2001). As RPST is not restricted to the introspective, individual level, quantitative methodologies are as well appropriate as qualitative methodologies (Trautwein & Ludtke, 2007; Wagner, 2003). Within RPST, a two-phase model is very well included and described, which can therefore combine qualitative and quantitative research methods (Groeben & Scheele, 2000). Following this methodological discussion, this study embraces the two-way model, using a qualitative approach in its first phase and a quantitative approach in its second phase.

Pre-Study

To explore the topic's aspects, an expert focus group was gathered that consisted of two pre-service teachers, two in-service teachers, and two PE researchers that were also lecturers in a PETE program on the higher educational level. The participants had diverse experience using ICT in PE. However, all participants read essential papers (Ince et al., 2006; Kretschmann, 2010; Pittman & Mohnsen, 2005) and skimmed relevant textbooks (Castelli & Fiorentino, 2008; Leight, 2012; Mohnsen, 2012) before the group discussion.

Within this expert focus group, a group discussion was performed (Cohen, Manion, & Morrison, 2011; Greenbaum, 1998). All participants were asked to present their thoughts and views about the integration of ICT in PE. The group discussion was semi-structured and moderated by one of the PE researchers. The following open questions served as a tentative interview guide (Foddy, 1993) to stimulate the discussion:

1. What ICTs do you know?
2. What ICTs can be used in PE?
3. What are the barriers to use ICTs in PE?
4. What is your general opinion about integrating ICT in PE?

The group discussion was recorded using an MP3 voice recorder and transcribed afterwards. The transcribed group discussion was analyzed by the two PE researches that took part in the expert focus group. The relevant discussion outcomes and participants' statements were extracted and rephrased into brief statements that could be used as items in a Likert-scaled questionnaire.

Instrument

The modeled statements that came out of the group discussion were grouped into topics. The evaluated statements were included as items in a questionnaire using a 5-point Likert scale (5=strongly agree, 1=strongly disagree). Eventually, the items could be organized into eight categories:

1. Student-related subjective theories (10 items)
2. Teaching-related subjective theories (8 items)
3. Teacher-related subjective theories (7 items)
4. Equipment-related subjective theories (7 items)
5. Computer literacy-related subjective theories (9 items)
6. Classroom management and organization-related subjective theories (8 items)
7. Social interaction-related subjective theories (8 items)
8. Innovative and modern teaching-related subjective theories (7 items)

In complement to the subjective theories-related part, a socio-demographic part was added to the questionnaire. Age, gender, professional experience (years in service), and multiple items for computer literacy were therefore included. The respective single items of the subjective theories-related topics are shown in Tables 1 to 9.

Data Collection

Conducting a convenient sample, a total of 120 questionnaires were sent to secondary schools in the area code of Stuttgart, Germany. Altogether, 20 secondary schools were involved in the initial sampling strategy. Only 57 questionnaires had been completed and were returned. The return rate was 47.5%.

Sample

The sample consisted of a total of 57 secondary school PE teachers ($M_{(age)}$=48.84 years; SD=1.39). Among the PE teachers, 26 were male and 31 were female. The average of years of experience was 19.67 years (SD=1.41). Therefore, the sample consisted of in-service PE teachers that have been working in their profession for such a long time that they can surely be treated as established and well experienced overall. All PE teachers had at least one PC or laptop in their respective household. There were no statistically significant differences in age or professional experience (years in service) according to gender (t-tests; $p>0.05$). The descriptive characteristics of the sample are shown in Table 1.

Table 1: Descriptive characteristics of study sample

Variables		N	%	Mean (M)	Standard Deviation (SD)
Age	Male	26	45.6	49.80	1.94
	Female	31	54.4	47.56	1.92
	Total	57	100	48.84	1.39
Professional Experience (Years in Service)	Male	26	45.6	16.56	1.96
	Female	31	54.4	18.70	2.10
	Total	57	100	19.67	1.41

Data Analysis

The survey data was analyzed using quantitative-research statistical-analysis methods (frequencies, t-test, reliability analysis, and (one-way) analysis of variance (ANOVA) including Tukey's HSD post-hoc test. The software IBM SPSS Statistics (Version 21) for Mac OS was used to perform the statistical procedures.

RESULTS

The subjective theory-results are presented to the degree of detail that in addition to means and standard deviations, percentages and frequencies for all values are given (Tables 2-9). This modus of presentation allows an in-depth showing of distribution and tendencies for each item within the sample group. Following the comprehensive data-presentation of the assessed subjective theories, the relations of gender, computer literacy, household computer ownership, and professional experience (years in service) to the PE teachers' subjective theories are presented.

Student-Related Subjective Theories

Looking at the subjective theories of the PE teachers in regard to pedagogical benefit generated for the students, the majority of the PE teachers tended to be undecided (S3, S4, S5, S6, S7, S8). The PE teachers rather thought that the use of ICT in PE promotes teamwork, and social and communicative learning (S2, S9). However, the vast majority of the PE teachers agreed that unmotivated students in PE can't be engaged by any ICT setting (S1). Although nearly half of the PE teachers were uncertain whether boys get more into ICT than girls, the other half nearly split their opinion on agreeing and disagreeing for this subjective theory (S10). Nonetheless, there was a slight tendency towards disagreement within S10. The complete findings according to student-related subjective theories are shown in Table 2.

Table 2: Student-Related Subjective Theories

Index	Subjective Theory	Strongly Agree (N) (%)	Agree (N) (%)	Uncertain (N) (%)	Disagree (N) (%)	Strongly Disagree (N) (%)	Mean (M)	Standard Deviation (SD)
S1	Students' study motivation can be increased by integrating ICT.	18 (31.6)	17 (29.8)	17 (29.8)	5 (8.8)	0 (0.0)	3.84	0.13
S2	Working with a Laptop is a team activity.	1 (1.8)	3 (5.3)	24 (42.1)	24 (42.1)	5 (8.8)	2.49	0.18
S3	Students can gather new information on their own.	2 (3.5)	15 (26.3)	30 (52.6)	9 (15.8)	1 (1.8)	3.14	0.19
S4	ICT-supported education is as equal effective in regard to learning outcomes as traditional education.	1 (1.8)	13 (22.8)	21 (36.8)	19 (33.3)	3 (5.3)	2.82	0.14
S5	Instructional tips, hints, and images on the computer make students become more adventurous.	4 (7.0)	8 (14.0)	29 (50.9)	14 (24.6)	2 (3.5)	2.96	0.17
S6	Not actively participating students can be mentors and advisors at PCs.	2 (3.5)	22 (38.6)	16 (28.1)	15 (26.3)	2 (3.5)	3.12	0.14
S7	If students are not motivated, ICT will not motivate them anyways.	20 (35.1)	29 (50.9)	5 (8.8)	2 (3.5)	1 (1.8)	4.14	0.20
S8	ICT integration fosters independent learning.	0 (0.0)	11 (19.3)	32 (56.1)	10 (17.5)	4 (7.0)	2.88	0.19
S9	ICT integration fosters social and communicative learning.	0 (0.0)	3 (5.3)	25 (43.9)	23 (40.4)	6 (10.5)	2.44	0.18
S10	Boys get more into ICT in PE than girls.	2 (3.5)	10 (17.5)	26 (45.6)	15 (26.3)	4 (7.0)	2.84	0.24

Teaching-Related Subjective Theories

Regarding the PE teachers' teacher-related subjective theories, the PE teachers seemed to be satisfied with their current teaching strategies (T1, T3, T6). They clearly favored traditional teaching resources such as images or a blackboard over ICT (T2). The overwhelming majority saw manifold movement, exploration, and free trial as the center of PE (T7). Nevertheless, the PE teachers deemed instructional technology such as animated images and video worthy of being useful in motor learning and feedback processes (T4, T6). A slight majority of the PE teachers would not use internet-searches as homework in PE. However, one third was uncertain about the benefit of internet-searches and close to 20% of the PE teachers would use them for homework in PE (T5). The complete findings according to teaching-related subjective theories are shown in Table 3.

Table 3: Teaching-Related Subjective Theories

Index	Subjective Theory	Strongly Agree (N) (%)	Agree (N) (%)	Uncertain (N) (%)	Disagree (N) (%)	Strongly Disagree (N) (%)	Mean (M)	Standard Deviation (SD)
T1	ICT integration does not lead to better content knowledge.	4 (7.0)	16 (28.1)	23 (40.4)	12 (21.1)	2 (3.5)	3.14	0.21
T2	Media as blackboard and (printed) images are more suitable in physical education.	7 (12.3)	22 (38.6)	16 (28.1)	7 (12.3)	5 (8.8)	3.33	0.19
T3	My teaching in physical education is successful without integrating any technology.	14 (24.6)	20 (35.1)	20 (35.1)	3 (5.3)	0 (0.0)	3.79	0.22
T4	Animated images (or short videos) can illustrate the diverse aspects of a movement or a technique well.	24 (42.1)	25 (43.9)	7 (12.3)	1 (1.8)	0 (0.0)	4.26	0.28
T5	Internet searches (e.g. ball games) are well suited as homework.	1 (1.8)	10 (17.5)	18 (31.6)	22 (38.6)	6 (10.5)	2.61	0.22
T6	Video recordings are better for individual feedback than personal feedback of the PE teacher.	9 (15.8)	13 (22.8)	24 (42.1)	8 (14.0)	3 (5.3)	3.30	0.19
T7	Despite ICT integrating, manifold movement, exploration, and free trial should remain the	45 (78.9)	9 (15.8)	3 (5.3)	0 (0.0)	0 (0.0)	4.74	0.45

	focus of the PE lesson.							
T8	Using educational software, PE content knowledge can be learned playfully.	0 (0.0)	13 (22.8)	26 (45.6)	14 (24.6)	4 (7.0)	2.84	0.25

Teacher-Related Subjective Theories

With regard to their own teaching load, the PE teachers perceived ICT rather as a burden than as a relief (TE2). Using video in PE would mean a thorough time-consuming preparation and post-processing as well as careful and focused guiding within the PE lesson (TE1). The PE teachers thought that ICT is not useful in motivating students (TE4), but saw an advantage in faster processing digital assessment data (TE7). However, the PE teachers tended to understand ICT as an important motor for professional teaching development (TE3). The majority of the PE teachers were uncertain about a gain in reputation with their students when integrating ICT in PE (TE5). They were also undecided about switching to a moderator role while using ICT in PE (TE6). The complete findings according to teacher-related subjective theories are shown in Table 4.

Table 4: Teacher-Related Subjective Theories

Index	Subjective Theory	Strongly Agree (N) (%)	Agree (N) (%)	Uncertain (N) (%)	Disagree (N) (%)	Strongly Disagree (N) (%)	Mean (M)	Standard Deviation (SD)
TE1	Using video in PE means thorough preparation, guidance, and post-processing by the teacher.	24 (42.1)	28 (49.1)	5 (8.8)	0 (0.0)	0 (0.0)	4.33	0.32
TE2	The physical education teacher is relieved through self-reliant learning scenarios using laptops.	0 (0.0)	8 (14.0)	15 (26.3)	31 (54.4)	3 (5.3)	2.49	0.30
TE3	ICT is the building block of the development of new teaching and learning methods.	7 (12.3)	24 (42.1)	23 (40.4)	3 (5.3)	0 (0.0)	3.61	0.26
TE4	I do not need ICT for getting students motivated.	26 (45.6)	19 (33.3)	8 (14.0)	4 (7.0)	0 (0.0)	4.18	0.25
TE5	Using modern teaching methods increases my reputation with the students.	3 (5.3)	13 (22.8)	23 (40.4)	16 (28.1)	2 (3.5)	2.98	0.21
TE6	To give the students more freedom, I gladly switch to the role of a moderator.	8 (14.0)	13 (22.8)	18 (31.6)	17 (29.8)	1 (1.8)	3.18	0.16
TE7	Computer programs facilitate a fast sorting and analyzing of assessment data (e.g. competition results).	37 (64.9)	16 (28.1)	3 (5.3)	1 (1.8)	0 (0.0)	4.56	0.37

Equipment-Related Subjective Theories

Most of the PE teachers perceived their available PE equipment not being outdated (E1), but stated that their school's instructional videos were outdated (E7). Almost half of them disregarded their respective school as a factor in ICT diversity, although the other half split its thoughts about their school to be an ICT diversity facilitator or hinderer (E4). In sum, the prospect of new, modern ICT equipment didn't seem to influence the PE teachers' teaching philosophies and habits (E2, E3, E5, E6). The complete findings according to equipment-related subjective theories are shown in Table 5.

Table 5: Equipment-Related Subjective Theories

Index	Subjective Theory	Strongly Agree (N) (%)	Agree (N) (%)	Uncertain (N) (%)	Disagree (N) (%)	Strongly Disagree (N) (%)	Mean (M)	Standard Deviation (SD)
E1	Most of our school's PE equipment is so outdated that it does not meat current standards.	4 (7.0)	7 (12.3)	18 (31.6)	22 (38.6)	6 (10.5)	2.67	0.20
E2	Our school can't afford to buy new PE equipment.	11 (19.3)	11 (19.3)	15 (26.3)	16 (28.1)	4 (7.0)	3.16	0.13
E3	Even if the equipment were there, I would not use ICT in PE.	7 (12.3)	10 (17.5)	15 (26.3)	17 (29.8)	8 (14.0)	2.84	0.13
E4	Our school supports ICT diversity.	4 (7.0)	15 (26.3)	26 (45.6)	9 (15.8)	3 (5.3)	3.14	0.23
E5	I would absolutely integrate ICT into my PE lessons, if it would be available.	9 (15.8)	9 (15.8)	22 (38.6)	15 (26.3)	2 (3.5)	3.14	0.18
E6	I think it would be more sensible to refurbish or expand our PE-related facilities than purchasing ICT.	21 (36.8)	17 (29.8)	13 (22.8)	5 (8.8)	1 (1.8)	3.91	0.19
E7	The instructional videos at our school are outdated.	21 (36.8)	19 (33.3)	12 (21.1)	2 (3.5)	3 (5.3)	3.93	0.21

Computer Literacy-Related Subjective Theories

The PE teachers felt that they were not as ICT competent as their students (CL9), and that younger teacher colleagues are more self-confident and engaged in using ICT (CL5). Nonetheless, most of the PE teachers were interested in continuing education events that feature ICT and PE (CL6). Although the feeling of not having sufficient knowledge was rather equally distributed (CL1), the majority of the PE teachers thought they had too little knowledge about possible pedagogical scenarios using ICT in PE (CL2). Even if their computer literacy were better, the PE teachers tended to decline using ICT in PE more often (CL3). The vast majority of PE teachers stated that they don't use ICT in PE because they are afraid of making a fool out of themselves in front of their students (CL7). The fact that the PE teachers didn't use ICT in PE frequently to prove their skills accompanies the results in regard to CL7 (CL8). However, most PE teachers believed that there were a lot of useful webpages for PE lessons available (CL4). The complete findings according to computer literacy-related subjective theories are shown in Table 6.

Table 6: Computer Literacy-Related Subjective Theories

Index	Subjective Theory	Strongly Agree (N) (%)	Agree (N) (%)	Uncertain (N) (%)	Disagree (N) (%)	Strongly Disagree (N) (%)	Mean (M)	Standard Deviation (SD)
CL1	I do not have sufficient experience to integrate ICT in PE.	5 (8.8)	12 (21.1)	19 (33.3)	13 (22.8)	8 (14.0)	2.88	0.15
CL2	I have too few knowledge about possible pedagogical scenarios using ICT in PE.	15 (26.3)	20 (35.1)	11 (19.3)	7 (12.3)	4 (7.0)	3.61	0.16
CL3	If my computer literacy were better, I would use ICT in PE more often.	3 (5.3)	9 (15.8)	12 (21.1)	22 (38.6)	11 (19.3)	2.49	0.18
CL4	There are many webpages containing ideas for diversified PE lessons.	11 (19.3)	20 (35.1)	18 (31.6)	6 (10.5)	2 (3.5)	3.56	0.18
CL5	Younger PE teacher colleagues are more engaged into ICT integration.	5 (8.8)	26 (45.6)	15 (26.3)	11 (19.3)	0 (0.0)	3.44	0.23
CL6	I am not interested in continuing education events in the area of ICT and PE.	9 (15.8)	5 (8.8)	12 (21.1)	24 (42.1)	7 (12.3)	2.74	0.19
CL7	I do not use ICT in PE because I am afraid to make a fool out of myself in front of the students.	1 (1.8)	7 (12.3)	3 (5.3)	23 (40.4)	23 (40.4)	1.95	0.22
CL8	I use ICT frequently to prove my ICT skills.	0 (0.0)	2 (3.5)	6 (10.5)	18 (31.6)	31 (54.4)	1.63	0.21
CL9	My students are better in using ICT than I am.	11 (19.3)	15 (26.3)	18 (31.6)	10 (17.5)	3 (5.3)	3.37	0.14

Classroom Management and Organization-Related Subjective Theories

Perceived massive teaching and administration workload is probably one of the reasons that prevent PE teachers from using ICT in PE (C1, C2, C3). Moreover, most of the PE teachers believed that integrating ICT takes away movement time from the PE lesson (C4). On the other hand, the majority of the PE teachers thought that ICT is good for preparing PE lessons (C5). Although the results for the value of using ICT to plan complex PE settings were nearly equally distributed, there was a slight tendency that the PE teachers neglect this statement (C6). Most of the PE teachers stated that ICT in PE is placed best into the last two years of secondary school education (C7). As one third of the PE teachers were undecided whether there is a fair relation between learning outcomes efficiency and ICT preparation effort when using ICT in PE (C8), about 50% of the PE teachers wouldn't say that there was a fair relation (C8). The complete findings according to classroom management and organization-related subjective theories are shown in Table 7.

Table 7: Classroom Management and Organization-Related Subjective Theories

Index	Subjective Theory	Strongly Agree (N) (%)	Agree (N) (%)	Uncertain (N) (%)	Disagree (N) (%)	Strongly Disagree (N) (%)	Mean (M)	Standard Deviation (SD)
C1	I can't integrate ICT because I am under time pressure to include the content standards completely.	5 (8.8)	14 (24.6)	14 (24.6)	17 (29.8)	7 (12.3)	2.88	0.14
C2	If I had smaller class sizes, I could imagine using ICT in PE.	5 (8.8)	21 (36.8)	16 (28.1)	11 (19.3)	4 (7.0)	3.21	0.18
C3	PE class time is too short to use ICT.	15 (26.3)	19 (33.3)	10 (17.5)	12 (21.1)	1 (1.8)	3.61	0.16
C4	The use of ICT decreases PE movement time.	13 (22.8)	18 (31.6)	17 (29.8)	6 (10.5)	3 (5.3)	3.56	0.16
C5	ICT is good for preparing PE lessons.	15 (26.3)	23 (40.4)	12 (21.1)	7 (12.3)	0 (0.0)	3.81	0.20
C6	A complex PE equipment set-up	3	12	17	16	9	2.72	0.16

	can easily be planned using ICT.	(5.3)	(21.1)	(29.8)	(28.1)	(15.8)		
C7	ICT is most likely placed best in the last two years of secondary school PE.	10 (17.5)	30 (52.6)	13 (22.8)	3 (5.3)	1 (1.8)	3.79	0.27
C8	Preparation effort and learning outcome efficiency are in fair relation to each other when using ICT in PE.	1 (1.8)	8 (14.0)	19 (33.3)	26 (45.6)	3 (5.3)	2.61	0.26

Social Interaction-Related Subjective Theories

While about 40% of the PE teachers were uncertain whether students learn to use ICT at home or not, close to 50% agreed that students learn to use ICT at home (SO1). About half of the PE teachers were uncertain whether demonstrating a movement or technique by a student is more efficient than using video (SO2). The other half of the PE teachers spread their opinions regarding SO2 almost equally on agreeing and disagreeing. About 50% of the PE teachers didn't think that working with a laptop in PE increases teamwork among students (SO3), whereas about 40% were uncertain about SO3. A similar distribution was assessed for the PE teachers' opinions about the positive effect of ICT on collaboration among other teacher colleagues (SO4).

Concerning the subjective theories that stated that the student-teacher relationship would suffer when using ICT in PE (SO5) and whether a webpage for their PE classes would be useful (SO6), the PE teachers' opinions were about equally distributed on agreement, disagreement, and uncertainty. Although there was a tendency towards disagreeing that internet forums would be helpful in communicating and comparing notes with PE teachers located at various schools (SO8), the overall distribution was similar to the subjective theories SO4 and SO5. Furthermore, the vast majority of PE teachers (more than 80%) held the opinion that playing sports and movement games increase PE enjoyment and facilitate communication better than ICT (SO8). The complete findings according to social interaction-related subjective theories are shown in Table 8.

Table 8: Social Interaction-Related Subjective Theories

Index	Subjective Theory	Strongly Agree (N) (%)	Agree (N) (%)	Uncertain (N) (%)	Disagree (N) (%)	Strongly Disagree (N) (%)	Mean (M)	Standard Deviation (SD)
SO1	Students learn to use ICT at home.	5 (8.8)	23 (40.4)	23 (40.4)	4 (7.0)	2 (3.5)	3.44	0.25
SO2	Demonstrating a movement or technique by a student is more efficient than using video.	4 (7.0)	14 (24.6)	30 (52.6)	7 (12.3)	2 (3.5)	3.19	0.27
SO3	Letting students work with a laptop in PE fosters their ability to work in a team (collaboration, communication in groups).	1 (1.8)	7 (12.3)	22 (38.6)	22 (38.6)	5 (8.8)	2.60	0.24
SO4	Using ICT in PE facilitates collaboration among teacher colleagues.	1 (1.8)	8 (14.0)	19 (33.3)	25 (43.9)	4 (7.0)	2.60	0.25
SO5	Using ICT in PE frequently makes the personal teacher-student relationship suffer.	5 (8.8)	10 (17.5)	16 (28.1)	20 (35.1)	6 (10.5)	2.79	0.17
SO6	A webpage for our PE classes would be useful.	6 (10.5)	11 (19.3)	16 (28.1)	15 (26.3)	9 (15.8)	2.82	0.13
SO7	Playing sports and movement games increase PE enjoyment and facilitate communication better than ICT.	27 (47.4)	20 (35.1)	9 (15.8)	1 (1.8)	0 (0.0)	4.28	0.27
SO8	Internet forums are helpful for PE teachers located at various schools to communicate and compare notes.	0 (0.0)	15 (26.3)	21 (36.8)	17 (29.8)	4 (7.0)	2.82	0.22

Innovative and Modern Teaching-Related Subjective Theories

The PE teachers' opinions, whether ICT belongs into PE class due to its ubiquitousness in todays' youth's lives, were equally distributed according to agreement, disagreement, and uncertainty (I1). Moreover, the PE teachers were relatively undecided whether modern (PE) teaching promotes ICT or not (I3). The PE teachers' opinions about the increased importance of ICT in PE in the future were also nearly equally distributed (I5). The majority of the PE teachers (75%) stated that they don't believe that ICT can replace traditional teaching, but can very well accompany it successfully (I6). Furthermore, the PE teachers haven't frequently heard from PE teachers from other schools that they used ICT in their respective PE classes (I7).

When it came to using ICT for school projects and after school programs, the majority of the PE teachers would use it for this occasions (I2). About 40% of the PE teachers thought that PETE programs should be infused with

more ICT, as 45% were uncertain about this statement (I4). The complete findings according to innovative and modern teaching-related subjective theories are shown in Table 9.

Table 9: Innovative and Modern Teaching-Related Subjective Theories

Index	Subjective Theory	Strongly Agree (N) (%)	Agree (N) (%)	Uncertain (N) (%)	Disagree (N) (%)	Strongly Disagree (N) (%)	Mean (M)	Standard Deviation (SD)
I1	Even though ICT is ubiquitous in the lives of children and adolescents, it does not belong into PE class.	3 (5.3)	16 (28.1)	17 (29.8)	19 (33.3)	2 (3.5)	2.98	0.20
I2	I could imagine ICT in PE-related school projects or after school programs.	16 (28.1)	24 (42.1)	15 (26.3)	2 (3.5)	0 (0.0)	3.95	0.23
I3	Modern (PE) teaching promotes ICT integration.	3 (5.3)	11 (19.3)	22 (38.6)	17 (29.8)	4 (7.0)	2.86	0.20
I4	ICT should play a bigger role in physical education teacher education programs.	4 (7.0)	21 (36.8)	26 (45.6)	5 (8.8)	1 (1.8)	3.39	0.26
I5	The importance of ICT in PE will increase in the future.	0 (0.0)	15 (26.3)	22 (38.6)	17 (29.8)	3 (5.3)	2.86	0.23
I6	ICT can't replace traditional teaching and learning methods, but complement and accompany it successfully.	14 (24.6)	29 (50.9)	10 (17.5)	3 (5.3)	1 (1.8)	3.91	0.26
I7	I frequently heard from other schools' PE teachers that they use ICT in their respective PE classes.	1 (1.8)	2 (3.5)	7 (12.3)	27 (47.4)	20 (35.1)	1.89	0.26

Gender and Subjective Theories

T-tests were performed to determine whether there was a relation between the subjective theories and gender. Among the 64 subjective theories, eight subjective theories showed statistically significant differences in regard to gender ($p<0.05$). No teaching-related, no equipment-related, and no classroom management and organization-related subjective theory showed statistically significant differences ($p>0.05$). To avoid excessive statistical reporting of statistically insignificant results and to remain brief, only the values of the statistically significant differences regarding gender are reported in Table 10.

Table 10: Gender and Subjective Theories about ICT and PE

Index	Subjective Theory	Gender	N	Mean (M)	Standard Deviation (SD)	t-Value	Significance
S6	Not actively participating students can be mentors and advisors at PCs.	Female	31	2.77	0.809	-2.735	0.008
		Male	26	3.42	1.203		
TE7	Despite ICT integrating, manifold movement, exploration, and free trial should remain the focus of the PE lesson.	Female	31	4.77	0.838	2.715	0.009
		Male	26	4.31	1.181		
M1	I do not have sufficient experience to integrate ICT in PE.	Female	31	3.16	1.272	2.066	0.044
		Male	26	2.54	1.279		
M3	If my computer literacy were better, I would use ICT in PE more often.	Female	31	2.77	0.784	2.117	0.039
		Male	26	2.15	1.321		
SO7	Playing sports and movement games increase PE enjoyment and facilitate communication better than ICT.	Female	31	4.48	0.744	2.019	0.048
		Male	26	4.08	0.832		
I4	ICT should play a bigger role in physical education teacher education programs.	Female	31	3.61	0.801	2.03	0.047
		Male	26	3.19	0.969		
I5	The importance of ICT in PE will increase in the future.	Female	31	2.65	0.864	-2.08	0.042
		Male	26	3.12	0.956		
I7	I frequently heard from other schools' PE teachers that they use ICT in their respective PE classes.	Female	31	1.68	0.881	-2.097	0.041
		Male	26	2.15	0.934		

For the subjective theory S6 (“Not actively participating students can be mentors and advisors at PCs.”), male PE teachers (M=3.42) had a statistically significant higher mean score than female PE teachers (M=2.77) (t=-2.735, p=0.008). For the subjective theory TE7 (“Despite ICT integrating, manifold movement, exploration, and free trial should remain the focus of the PE lesson.”), female PE teachers (M=4.77) had a statistically significant higher mean score than male PE teachers (M=4.31) (t=2.715, p=0.009).

For the subjective theory M1 (“I do not have sufficient experience to integrate ICT in PE.”), female PE teachers (M=3.16) had a statistically significant higher mean score than male PE teachers (M=2.54) (t=2.066, p=0.044). For the subjective theory M3 (“If my computer literacy were better, I would use ICT in PE more often.”), female

PE teachers (M=2.77) had a statistically significant higher mean score than male PE teachers (M=2.15) (t=2.117, p=0.039).

For the subjective theory SO7 ("Playing sports and movement games increase PE enjoyment and facilitate communication better than ICT."), female PE teachers (M=2.77) had a statistically significant higher mean score than male PE teachers (M=2.15) (t=2.117, p=0.039).

For the subjective theory I4 ("ICT should play a bigger role in physical education teacher education programs."), female PE teachers (M=3.61) had a statistically significant higher mean score than male PE teachers (M=3.19) (t=2.03, p=0.047). For the subjective theory I5 ("The importance of ICT in PE will increase in the future."), male PE teachers (M=3.12) had a statistically significant higher mean score than female PE teachers (M=2.65) (t=-2.08, p=0.042). For the subjective theory I7 ("I frequently heard from other schools' PE teachers that they use ICT in their respective PE classes."), male PE teachers (M=2.15) had a statistically significant higher mean score than female PE teachers (M=1.68) (t=-2.097, p=0.041).

Computer Literacy and Subjective Theories

For assessing the PE teachers' computer literacy, a 10-item subscale was used within the questionnaire. The items were 5-point Likert-scaled (5=very good, 1=very poor). The scale returned an excellent reliability score (Cronbach's alpha=0.90). There were no statistically significant differences in gender (p>0.05), except for the item "Installation of Hardware" (t=-3.006, p=0.004). The single item scores are shown in Table 11.

Table 11: PE Teacher's Computer Literacy

Item	Mean (M)			Standard Deviation (SD)		
	Female	Male	Total	Female	Male	Total
Installation of Hardware	2.13	3.08	2.56	0.23	0.21	1.27
Installation of Software	2.90	3.42	3.14	0.20	0.21	1.13
Using Word Processing Software	3.94	3.77	3.86	0.17	0.18	0.92
Using Educational Software	3.10	2.92	3.02	0.19	0.21	1.08
Using the Internet	4.04	3.81	3.93	0.14	0.15	0.75
Designing a Webpage	1.77	1.81	1.79	0.18	0.24	1.11
Graphics Editing Software	2.81	3.19	2.98	0.22	0.23	1.17
Video Editing Software	1.65	2.23	1.91	0.18	0.25	1.14
Audio Editing Software	1.74	2.23	1.96	0.19	0.25	1.16
Knowledge to Include ICT in Education	2.81	2.96	2.88	0.19	0.20	1.02

To investigate the influence of computer literacy on the PE teachers' subjective theories, the PE teachers were grouped into three groups in regard to their computer literacy mean scores (low computer literacy level, average computer literacy level, and high computer literacy level). After that, a one-way analysis of variance (ANOVA) accompanied with a Tukey's HSD post-hoc test was conducted. Among the 64 subjective theories, 13 subjective theories showed statistically significant differences in regard to computer literacy levels (p<0.05). No teaching-related, no teacher-related, and no innovative and modern teaching-related subjective theory showed statistically significant differences (p>0.05).

For the subjective theory S3 ("Students can gather new information on their own."), PE teachers' computer literacy levels differed statistically significantly (F=3.458, p=0.039). PE teachers with an average computer literacy level score showed a statistically significantly higher mean (M=3.41) than PE teachers with a high computer literacy level score (M=2.86) (p=0.036).

For the subjective theory S4 ("ICT-supported education is as equal effective in regard to learning outcomes as traditional education."), PE teachers' computer literacy levels differed statistically significantly (F=4.520, p=0.015). PE teachers with a low computer literacy level score showed a statistically significantly higher mean (M=3.60) than PE teachers with a high computer literacy level score (M=2.57) (p=0.012).

For the subjective theory S5 ("Instructional tips, hints, and images on the computer make students become more adventurous."), PE teachers' computer literacy levels differed statistically significantly (F=6.273, p=0.004). PE teachers with a low computer literacy level score showed a statistically significantly higher mean (M=3.80) than PE teachers with an average computer literacy level score (M=2.85) (p=0.009) and PE teachers with a high computer literacy level (M=2.71) (p=0.004).

For the subjective theory S9 (“ICT integration fosters social and communicative learning.”), PE teachers’ computer literacy levels differed statistically significantly (F=3.923, p=0.026). PE teachers with a low computer literacy level score showed a statistically significantly higher mean (M=2.90) than PE teachers with a high computer literacy level score (M=2.14) (p=0.022).

For the subjective theory E5 (“I would absolutely integrate ICT into my PE lessons, if it would be available.”), PE teachers’ computer literacy levels differed statistically significantly (F=3.923, p=0.026). A Tukey’s HSD post-hoc test didn’t show any statistically significantly differences between the computer literacy level groups.

For the subjective theory CL1 (“I do not have sufficient experience to integrate ICT in PE.”), PE teachers’ computer literacy levels differed statistically significantly (F=13.292, p<0.001). PE teachers with a low computer literacy level score showed a statistically significantly lower mean (M=1.60) than PE teachers with an average computer literacy level score (M=2.85) (p=0.003) and PE teachers with a high computer literacy level score (M=3.52) (p<0.001).

For the subjective theory CL2 (“I have too few knowledge about possible pedagogical scenarios using ICT in PE.”), PE teachers’ computer literacy levels differed statistically significantly (F=15.938, p<0.001). PE teachers with a low computer literacy level score showed a statistically significantly lower mean (M=2.10) than PE teachers with an average computer literacy level score (M=3.73) (p<0.001) and PE teachers with a high computer literacy level score (M=4.19) (p<0.001).

For the subjective theory CL3 (“If my computer literacy were better, I would use ICT in PE more often.”), PE teachers’ computer literacy levels differed statistically significantly (F=4.770, p=0.012). PE teachers with a low computer literacy level score showed a statistically significantly lower mean (M=1.70) than PE teachers with a high computer literacy level score (M=2.95) (p=0.010).

For the subjective theory CL7 (“I do not use ICT in PE because I am afraid to make a fool out of myself in front of the students.”), PE teachers’ computer literacy levels differed statistically significantly (F=4.890, p=0.011). PE teachers with a low computer literacy level score showed a statistically significantly lower mean (M=1.20) than PE teachers with a high computer literacy level score (M=2.38) (p=0.009).

For the subjective theory CL8 (“I use ICT frequently to prove my ICT skills.”), PE teachers’ computer literacy levels differed statistically significantly (F=5.118, p=0.009). PE teachers with a low computer literacy level score showed a statistically significantly higher mean (M=2.10) than PE teachers with a high computer literacy level score (M=1.24) (p=0.013).

For the subjective theory CL9 (“My students are better in using ICT than I am.”), PE teachers’ computer literacy levels differed statistically significantly (F=11.090, p<0.001). PE teachers with a high computer literacy level score showed a statistically significantly higher mean (M=4.14) than PE teachers with a low computer literacy level score (M=2.60) (p<0.001) and PE teachers with an average computer literacy level score (M=3.04) (p=0.001).

For the subjective theory C1 (“I can't integrate ICT because I am under time pressure to include the content standards completely.”), PE teachers’ computer literacy levels differed statistically significantly (F=3.753, p=0.030). A Tukey’s HSD post-hoc test didn’t show any statistically significantly differences between the computer literacy level groups.

For the subjective theory C8 (“Preparation effort and learning outcome efficiency are in fair relation to each other when using ICT in PE.”), PE teachers’ computer literacy levels differed statistically significantly (F=3.460, p=0.039). PE teachers with an average computer literacy level score showed a statistically significantly higher mean (M=2.85) than PE teachers with a high computer literacy level score (M=2.24) (p=0.039).

In reference to the same intention as for Table 10, to avoid excessive statistical reporting of statistically insignificant results and to remain brief, only the values of the statistically significant differences regarding the PE teachers’ computer literacy levels are reported in Table 12.

Table 12: ANOVA for PE Teachers' Subjective Theories and Computer Literacy

Index	Subjective Theory	Computer Literacy Level	N	Mean (M)	F-Value	p-Value	Difference (Tukey)	Difference p-Value
S3	Students can gather new information on their own.	Low	10	3.00	3.458	0.039	Low, Average	0.298
		Average	26	3.41			Low, High	0.876
		High	21	2.86			Average, High	0.036
S4	ICT-supported education is as equal effective in regard to learning outcomes as traditional education.	Low	10	3.60	4.520	0.015	Low, Average	0.055
		Average	26	2.81			Low, High	0.012
		High	21	2.57			Average, High	0.645
S5	Instructional tips, hints, and images on the computer make students become more adventurous.	Low	10	3.80	6.273	0.004	Low, Average	0.009
		Average	26	2.85			Low, High	0.004
		High	21	2.71			Average, High	0.851
S9	ICT integration fosters social and communicative learning.	Low	10	2.90	3.923	0.026	Low, Average	0.302
		Average	26	2.50			Low, High	0.022
		High	21	2.14			Average, High	0.218
E5	I would absolutely integrate ICT into my PE lessons, if it would be available.	Low	10	3.70	3.347	0.043	Low, Average	0.538
		Average	26	3.27			Low, High	0.954
		High	21	2.71			Average, High	0.202
CL1	I do not have sufficient experience to integrate ICT in PE.	Low	10	1.60	13.292	<0.001	Low, Average	0.003
		Average	26	2.85			Low, High	<0.001
		High	21	3.52			Average, High	0.054
CL2	I have too few knowledge about possible pedagogical scenarios using ICT in PE.	Low	10	2.10	15.938	<0.001	Low, Average	<0.001
		Average	26	3.73			Low, High	<0.001
		High	21	4.19			Average, High	0.251
CL3	If my computer literacy were better, I would use ICT in PE more often.	Low	10	1.70	4.770	0.012	Low, Average	0.172
		Average	26	2.42			Low, High	0.010
		High	21	2.95			Average, High	0.218
CL7	I do not use ICT in PE because I am afraid to make a fool out of myself in front of the students.	Low	10	1.20	4.890	0.011	Low, Average	0.162
		Average	26	1.88			Low, High	0.009
		High	21	2.38			Average, High	0.213
CL8	I use ICT frequently to prove my ICT skills.	Low	10	2.10	5.118	0.009	Low, Average	0.478
		Average	26	1.77			Low, High	0.013
		High	21	1.24			Average, High	0.054
CL9	My students are better in using ICT than I am.	Low	10	2.60	11.090	<0.001	Low, Average	0.457
		Average	26	3.04			Low, High	<0.001
		High	21	4.14			Average, High	0.001
C1	I can't integrate ICT because I am under time pressure to include the content standards completely.	Low	10	2.30	3.753	0.030	Low, Average	0.067
		Average	26	3.27			Low, High	0.867
		High	21	2.52			Average, High	0.076
C8	Preparation effort and learning outcome efficiency are in fair relation to each other when using ICT in PE.	Low	10	2.80	3.460	0.039	Low, Average	0.988
		Average	26	2.85			Low, High	0.189
		High	21	2.24			Average, High	0.039

Household Computer Ownership and Subjective Theories

To investigate the influence of household computer ownership on the PE teachers' subjective theories, the PE teachers were grouped into three groups in regard to the number of computers (including laptops) in their household (1, 2, and 3 or more). After that, a one-way ANOVA accompanied with a Tukey's HSD post-hoc test was conducted. Among the 64 subjective theories, only five subjective theories showed statistically significant differences regarding household computer ownership ($p<0.05$). No student-related, no teaching-related, no teacher-related, no social interaction-related, and no innovative and modern teaching-related subjective theory showed statistically significant differences ($p>0.05$).

For the subjective theory E7 ("The instructional videos at our school are outdated."), PE teachers' number of owned household computers differed statistically significantly ($F=4.047$, $p=0.023$). PE teachers with only one owned household computer showed a statistically significantly higher mean ($M=4.64$) than PE teachers with three or more owned household computers ($M=3.58$) ($p=0.018$).

For the subjective theory CL1 ("I do not have sufficient experience to integrate ICT in PE."), PE teachers' number of owned household computers differed statistically significantly ($F=3.277$, $p=0.045$). PE teachers with only one owned household computer showed a statistically significantly higher mean ($M=3.64$) than PE teachers with three or more owned household computers ($M=2.62$) ($p=0.037$).

For the subjective theory CL3 ("If my computer literacy were better, I would use ICT in PE more often."), PE teachers' number of owned household computers differed statistically significantly ($F=5.068$, $p=0.010$). PE

teachers with only one owned household computer showed a statistically significantly higher mean (M=3.27) than PE teachers with three or more owned household computers (M=2.08) (p=0.008).

For the subjective theory CL5 ("If my computer literacy were better, I would use ICT in PE more often."), PE teachers' number of owned household computers differed statistically significantly (F=4.623, p=0.014). PE teachers with only one owned household computer showed a statistically significantly higher mean (M=3.91) than PE teachers with three or more owned household computers (M=23.08) (p=0.024).

For the subjective theory C1 ("I can't integrate ICT because I am under time pressure to include the content standards completely."), PE teachers' computer literacy levels differed statistically significantly (F=3.537, p=0.036). PE teachers with only one owned household computer showed a statistically significantly lower mean (M=2.00) than PE teachers with two owned household computers (M=3.05) (p=0.047) and PE teachers with three or more owned household computers (M=3.00) (p=0.048).

Again, to avoid excessive statistical reporting of statistically insignificant results and to remain brief, only the values of the statistically significant differences regarding the PE teachers' household computers ownership are reported in Table 13.

Table 13: ANOVA for PE Teachers' Subjective Theories and Household Computer Ownership

Index	Subjective Theory	Household Computers	N	Mean (M)	F-Value	p-Value	Difference (Tukey)	Difference p-Value
E7	The instructional videos at our school are outdated.	1	11	4.64	4.047	0.023	1,2	0.245
		2	20	4.00			1, 3 or more	0.018
		3 or more	26	3.58			2, 3 or more	0.368
CL1	I do not have sufficient experience to integrate ICT in PE.	1	11	3.64	3.277	0.045	1,2	0.125
		2	20	3.80			1, 3 or more	0.037
		3 or more	26	2.62			2, 3 or more	0.845
CL3	If my computer literacy were better, I would use ICT in PE more often.	1	11	3.27	5.068	0.010	1,2	0.219
		2	20	2.60			1, 3 or more	0.008
		3 or more	26	2.08			2, 3 or more	0.231
CL5	Younger PE teacher colleagues are more engaged into ICT integration.	1	11	3.91	4.623	0.014	1,2	0.699
		2	20	3.65			1, 3 or more	0.024
		3 or more	26	3.08			2, 3 or more	0.071
C1	I can't integrate ICT because I am under time pressure to include the content standards completely.	1	11	2.00	3.537	0.036	1,2	0.047
		2	20	3.05			1, 3 or more	0.048
		3 or more	26	3.00			2, 3 or more	0.988

Professional Experience (Years in Service) and Subjective Theories

To investigate the influence of the PE teachers' professional experience (years in service) on their subjective theories, the PE teachers were grouped into three groups in regard to the years they were in service (1-10, 11-20, and 21 or more). After that, a one-way ANOVA accompanied with a Tukey's HSD post-hoc test was conducted. Among the 64 subjective theories, only three subjective theories showed statistically significant differences regarding years in service ($p<0.05$). No student-related, no teaching-related, no teacher-related, no social interaction-related, no classroom management and organization-related, and no innovative and modern teaching-related subjective theory showed statistically significant differences ($p>0.05$). The statistically significant ANOVA and Tukey's HSD post-hoc test results regarding PE teachers' professional experience (years in service) and their subjective theories about ICT and PE are shown in Table 14.

Table 14: ANOVA for PE Teachers' Professional Experience (Years in Service) and Subjective Theories

Index	Subjective Theory	Years in Service (Years)	N	Mean (M)	F-Value	p-Value	Difference (Tukey)	Difference p-Value
E5	I would absolutely integrate ICT into my PE lessons, if it would be available.	1-10	20	3.80	7.989	0.001	1-10, 11-20	0.092
		11-20	14	3.07			1-10, 21 or more	0.001
		21 or more	23	2.61			11-20, 21 or more	0.350
CL7	I do not use ICT in PE because I am afraid to make a fool out of myself in front of the students.	1-10	20	1.60	4.616	0.014	1-10, 11-20	0.992
		11-20	14	1.64			1-10, 21 or more	0.022
		21 or more	23	2.43			11-20, 21 or more	0.058
CL9	My students are better in using ICT than I am.	1-10	20	2.90	4.516	0.015	1-10, 11-20	0.682
		11-20	14	3.21			1-10, 21 or more	0.013
		21 or more	23	3.87			11-20, 21 or more	0.182

For the subjective theory E1 ("I would absolutely integrate ICT into my PE lessons, if it would be available."), PE teachers' years in service differed statistically significantly (F=7.989, p=0.001). PE teachers who were 1 to

10 years in service showed a statistically significantly higher mean (M=3.80) than PE teachers who were 21 or more years in service (M=2.61) (p=0.001).

For the subjective theory CL1 ("I do not use ICT in PE because I am afraid to make a fool out of myself in front of the students."), PE teachers' years in service differed statistically significantly (F=4.616, p=0.014). PE teachers who were 1 to 10 years in service showed a statistically significantly lower mean (M=1.60) than PE teachers who were 21 or more years in service (M=2.43) (p=0.022).

For the subjective theory CL9 ("My students are better in using ICT than I am."), PE teachers' years in service differed statistically significantly (F=4.516, p=0.015). PE teachers who were 1 to 10 years in service showed a statistically significantly lower mean (M=2.90) than PE teachers who were 21 or more years in service (M=3.87) (p=0.013).

DISCUSSION AND CONCLUSIONS

This study's aim was to investigate the subjective theories of in-service PE teachers about integrating ICT into PE. Using a RPST scientific framework, a quantitative research instrument was developed and diverse data on the study's subject field was collected and analyzed. In the following, the study's results will be discussed in regard to theoretical aspects and implications, and other findings in the field.

Student-Related Subjective Theories

The PE teachers' overall agreement with the subjective theory that stated that the students study motivation can't be increased by ICT (S1) isn't easy to discuss, as there is not much objective evidence to compare for PE. In general, innovative instructional methods easily raise the motivational level of school students (Brophy, 2010). However, putting a PC into a classroom doesn't make a low quality teaching and motivational climate high quality. For the use of technology (pedometers, heart rate monitors, video analysis, and picture boards) in physical education and physical activity behavior outside school (Cox, Williams, & Smith, 2007), and especially for exergaming in PE (Chen, 2013), there is empirical evidence that student's motivation benefits from ICT involvement. On the other hand, simply putting an isolated teaching tool into an educational context doesn't raise the motivational climate if not in tune with a careful conducted instructional design (Morgan & Kingston, 2005). Speculating about the difference between S1 and the literature, here may be a bias in the PE teachers, either regarding technology as an instructional method and/or the belief that unmotivated students can't be motivated anyways. Although the subjective theory S7 ("If students are not motivated, ICT will not motivate them anyways.") isn't distributed clearly towards one direction, S7 didn't focus on the latter general belief, but on ICT. S7 therefore doesn't help much determining the underlying attitude in question.

The fact that the PE teachers split their subjective theories reports on whether girls or boys get more into ICT (S10) mirrors the common uncertainty and prejudices about gender-related tech-savviness (McGrath, 2004). Although there may be differences in terms of attitude and use with the boys in the clear advantage regarding tech-savviness, especially in regard to computer and video game cultures (Kay, 2007), this study's PE teachers show mixed views. On the one hand, this may state a positive trend towards an equal gender treatment in PE, but may lead to less individual-centered teaching on the other hand. Furthermore, as motivation toward PE differs significantly between boys and girls, with girls showing a large decrease aging (Parish & Treasure, 2003), an interrelation between motivation, and ICT literacy and attitudes might be assumed (Vekiri, 2010). This study's PE teachers showed similar distribution of beliefs about girls' and boy's ICT savviness as in other studies that examined non-PE teachers (Sang, Valcke, van Braak, Tondeur, & Zhu, 2011; Vekiri, 2013; Wikan & Molster, 2011).

The PE teachers' central tendency for the subjective theories S3, S4, S5, S6, S7, and S8 may be caused by a feeling of uncertainty (Meldrum, 2011; Semiz & Ince, 2012) due to their lack in practical experience with the particular ICT topic. Moreover, a lack of content knowledge may prevent most of the PE teachers from a clear decision, as ICT has most likely not been part of their pre-service education (Hetland & Strand, 2010). Unclear facts about individual and team learning in PE in general, and integrated ICT activities (Ranguelov, Horvath, Dalferth, & Noorani, 2011) may add to the PE teachers' central tendency.

Teaching-Related Subjective Theories

The results for the subjective theories T1, T3, T4, and T6 confirm the general findings that (PE) teachers tend to stick to their teaching methods that they have used over the course of their careers (Mosston & Ashworth, 2008; Semiz & Ince, 2012; Strand & Bender, 2011). The results for the subjective theories T4 and T6 may support this explanation, as it can certainly be assumed that video feedback is a common method as well in PETE and PE (Fiorentino, 2004; J. Lim, Henschel Pellett, & Pellett, 2009).

Especially the results for the subjective theory T3 ("My teaching in physical education is successful without integrating any technology") reveal that this study's sample may indeed include a negative bias towards ICT in PE in the PE teachers (Kretschmann, 2012). As the vast majority of the PE teachers is clearly in favor for the subjective theory T7 ("Despite ICT integrating, manifold movement, exploration, and free trial should remain the focus of the PE lesson."), it may be inferred that the study's PE teachers don't think of PE and ICT being connected at first sight. For T3 and T7, the ICT-skeptical bias may as well blend in with the PE teachers' tendency to stick to their established teaching methods and resist to change (Zimmerman, 2006).

The mixed results with a tendency for disagreeing for the subjective theory T5 ("Internet searches (e.g. ball games) are well suited as homework.") are in line with the common approach to only include little or no homework in PE (Zavatto et al., 2005). The PE teachers may not use the Internet for homework, although there are plenty of PE-related webpages available (Elliott, Stanec, McCollum, & Stanley, 2007; Mohnsen & Roblyer, 2013).

Teacher-Related Subjective Theories

The results for the subjective theories T1 and T2 suggest that the PE teachers see ICT in PE as an add that needs special attention, affecting their PE lesson planning, and causing stress and time-management issues. According to other findings, these attitudes are rather common among (PE) teachers (Afshari, Abu Bakar, Luan, Abu Samah, & Say Fooi, 2009; Papastergiou, 2010). However, not only ICT is regarded as an external pressure for change. General curricular, policy, and organizational changes may rather be deemed as a burden as well (Petrie & Hunter, 2011).

The rather negative results for the subjective theory TE4 ("I do not need ICT for getting students motivated.") are expected as S1 and S7 revealed a disbelief in the PE teachers that ICT can have a positive motivational effect in PE. The switch to the introspective personal perspective of the teacher didn't change these aspect-specific results' tendency.

The PE teachers admitted that there are major benefits of digital assessment data (TE7) despite being rather skeptical towards ICT in PE. But digital assessment data may be a special case among technology use in PE. As national and state physical fitness tests implementations have increased (Wilson, 2011), more time and effort has to be spent on assessing and administrating test data. Using ICT for administrating students' test data may be more time- and cost-efficient than traditional paper-pencil methods (Mosier, 2012). As testing is mandatory in most cases and doesn't directly refer to PE class teaching methods, PE teachers may not classify it belonging to their personal PE teaching philosophy and teaching methods context, causing a rather positive attitude towards ICT use in this case.

The PE teachers clearly see the potential of PE development and their personal development (T3) according to ICT. Despite their skeptical attitude, the PE teachers don't neglect the fact of technology development and its increasing infusion into PE programs (Kretschmann, 2010; Mears, 2009a; Papastergiou, 2010). The PE teachers seem to see the direct connection to 21st century skills and policy development (Sanders & Witherspoon, 2012), but seem also to not transfer the ICT motor to their own teaching.

As the PE teachers tend to be undecided whether an increased ICT use in PE would also increase their reputation with the students (T5), teacher credibility issues in regard to ICT in PE (Bouck, Flanagan, Heutsche, Okolo, & Englert, 2011; Hergüner, 2011) may not be clear to PE teachers. Whether a PE teacher gains reputation with the student by using ICT in PE may depend on the teacher, the students, the school culture, or in sum, the case.

Similar to the teaching-related subjective theories T1, T3, T4, and T6, the teacher-related subjective theory TE6 ("To give the students more freedom, I gladly switch to the role of a moderator."), the PE teachers may stick to their known teaching strategies they feel comfortable with. A change in the perceived and intended role when integrating ICT can't be done instantly by most teachers (Schibeci et al., 2008). The PE teachers therefore may be not familiar with a moderator role in PE, being used to a command teaching style (Mosston & Ashworth, 2008) and additionally be not familiar to different roles in ICT implementation (Uibu & Kikas, 2008).

Equipment-Related Subjective Theories

Although lack of equipment is prominent within the PE discussion (Jenkinson & Benson, 2010; Kinnunen & Lewis, 2013), this study's PE teachers perceive their available equipment as not being outdated (E1). However, they regard instructional support-related videos available at their school outdated (E7), which is in line with the findings of Thomas and Stratton (2006) who reported less up-to-date technological equipment in school PE. As the commercial instructional video releases (Mohnsen & Thompson, 1997) have declined, it's less likely that

schools have purchased the latest published ones. The availability of free PE-related instructional videos on the Internet doesn't make expensive commercial videos attractive any more (Quennerstedt, 2013). Limited evidence is available, stating that limited budget influences technology use in PE (Woods et al., 2008). However, the items E1 and E7 didn't differentiate between electronic devices and media, and non-electronic analogue material. Therefore, there is a lack of clarity regarding this distinction within the PE teachers' perceptions.

The PE teachers have a mixed perception of their respective school being a factor in ICT implementation (E4). Nevertheless, literature findings on ICT implementation clearly report the school itself as an influencing factor (Afshari et al., 2009). It may be speculated that at most of the schools, the principal doesn't recognize PE as an ICT-related subject and therefore may not support or hinder PE in technology integration. However, the principals' influence on budget and school-wide curricular integration in terms of PE may not be underestimated (Brockmeier, Sermon, & Hope, 2005; Staples, Pugach, & Himes, 2005).

Equipment-related subjective theories in general (E2, E3, E5, and E6) seem to be independent from the PE teachers' teaching philosophy and habits. For instance, even if technology were available for PE the teachers wouldn't include them (E5). This may be explained by the negative technology use bias of the sample and/or by the lack of the PE teachers' instructional knowledge regarding technology in PE (Johns, 2003; Semiz & Ince, 2012).

Computer Literacy-Related Subjective Theories

The results for the subjective theory CL5 ("Younger PE teacher colleagues are more engaged into ICT integration.") are in line with the findings of Yaman (C. Yaman, 2008), confirming that age is a factor. General findings on teacher's computer and technology competence also state that teachers' age influence teachers' technology adoption (Buabeng-Andoh, 2012).

The fact that PE teachers perceive themselves not being as competent in ICT compared to their students (CL9) may or may not change over the following PE teacher generations. One line of argumentation may proclaim a everlasting gap between teachers' ICT competence level and students' ICT competence level caused by the "natural" age difference (Guo, Dobson, & Petrina, 2008). An alternative line of argumentation may lead to teachers and students being on an equal or at least similar ICT competence level, as future generations of (PE) teachers will be digital natives themselves (Prensky, 2010). However, students' and teachers' perceptions according to computer and ICT literacy, and actual abilities may differ (Grant, Malloy, & Murphy, 2009; Sarfo & Ansong-Gyimah, 2010). This means that the confidence level in the PE teachers on integrating ICT in PE may therefore ground on mere perceptions rather than facts about students' computer and ICT literacy.

The PE teachers' feelings about not having sufficient knowledge and experience according to the pedagogical use of ICT in general and in PE (CL1 and CL2) are most likely influenced by the lack of technology method content within their professional education (Semiz & Ince, 2012; Woods et al., 2008). However, the negative results for the subjective theory CL3 ("If my computer literacy were better, I would use ICT in PE more often.") may confirm the sample's negative technology bias again. It is likely that insufficient knowledge and experience with ICT and PE influences the likelihood of ICT adaption and encouragement of ICT use in PE (C. Yaman, 2008; M. Yaman, 2007b).

The results for the subjective theories CL7 ("I do not use ICT in PE because I am afraid to make a fool out of myself in front of the students.") and CL8 ("I use ICT frequently to prove my ICT skills.") suggest that the PE teachers tend to choose teaching methods they feel safe to use without disruptions, especially in regard to ICT in the classroom (Ertmer, 2005). Non-PE teachers have also reported feeling anxious about using ICT when they think that their students know more about ICT than they do (Balanskat, Blamire, & Kefala, 2006).

The PE teachers seem to be aware of webpages for PE and their usefulness for their profession (CL4). This is not surprising, as the PE teachers' computer literacy level was sufficient to determine the relevant webpages. Nonetheless, there seems to be a gap between the knowledge of available teaching and learning resources and its implementation (Ertmer & Ottenbreit-Leftwich, 2010).

Classroom Management and Organization-Related Subjective Theories

The PE teachers' perceptions about lack of time, curriculum content pressure, and organizational structures like class size in PE that increase teaching stress (C1, C2, and C3) are accompanied by the literature (Afshari et al., 2009; Thomas & Stratton, 2006). The results for the subjective theory C8 ("Preparation effort and learning outcome efficiency are in fair relation to each other when using ICT in PE.") accompany the PE teachers' perceptions about these barriers. The perceived effort in adapting new teaching methods or content is always

judged not being time- and cost-efficient by (PE) teachers (Penuel, Fishman, Yamaguchi, & Gallagher, 2007; Thomas & Stratton, 2006).

The PE teachers' belief that technology use in PE decreases "precious" movement and physical activity time (C4) within PE lessons may be closely connected to an understanding of PE that doesn't promote ICT integration (Kretschmann, 2010). However, the PE teachers are aware about the benefit of using ICT for PE lesson planning and preparation (C5), but were unsure about complex settings in PE (C6). This suggests that PE teachers may tackle ICT integration from a reflective perspective (Tsangaridou & O'Sullivan, 1994), considering ICT for diverse purposes (Tearle & Golder, 2008). Again, (PE) teachers' tendency to stick to known and established teaching methods may as well be related to the PE teachers' uncertainty about complex PE settings, as these settings are perceived as challenging for both expert and beginner teachers (Rich & Hannafin, 2009; Shovala, Erlicha, & Fejgina, 2010). Adding an extra factor such ICT may be perceived as making a complex situation even more complex.

The results for the subjective theory C7 ("ICT is most likely placed best in the last two years of secondary school PE.") suggest that PE teachers' teaching strategies and philosophies are bound to grade level. As it is obvious that primary school PE and secondary school PE need different appropriate teaching approaches (Hastie & Martin, 2005; Himberg, Hutchinson, & Roussell, 2002), teachers are assumed to choose grade level-specific teaching methods. The fact that the PE teachers judged ICT more appropriately placed into the last two years of secondary school may be explained by the belief that students at this stage of their educational attainment have gathered more computer and ICT literacy over their past school career, making them probably more likely to adapt ICT in subjects that are not primary ICT-related. Moreover, students nearing the end of their school education may be in their cognitive and metacognitive prime (Pallrand & Moretti, 1980), potentially allowing a wider range of teaching and learning methods. It may be inferred that the PE teachers think that ICT integration is better suited for more advanced students due to their perception that integrating ICT in PE is more complex than traditional teaching methods. The position statement of the National Association for Sport and Physical Education (NASPE) also proclaims an age-appropriate ICT use (National Association for Sport and Physical Education (NASPE), 2009).

Social Interaction-Related Subjective Theories

The varying results in the subjective theory SO1 ("Students learn to use ICT at home.") may be caused by the PE teachers varying perceptions of their students' computer and media socialization (Daunic, 2011). Although it is widely clear that students are socialized ubiquitously in their home environment (Morimoto & Friedland, 2011), PE teachers perceive regional differences (Ince et al., 2006) and/or may subsume ICT education under school education purposes in general or for their respective school (Vanderlinde, Dexter, & van Braak, 2012; Wastiau et al., 2013).

The varying results for the subjective theory SO2 ("Demonstrating a movement or technique by a student is more efficient than using video.") may be explained by mixed perceptions, knowledge, and skill levels regarding the use of video in PE. The studies conducted by M. Yaman (2007b) and C. Yaman (2008) also featured video and PE, whereas scores for PE teachers' competencies showed similar results. Despite having multiple sources of pedagogical scenarios for video in PE available (Cassidy, Stanley, & Bartlett, 2006; Leight, 2012; J. Lim et al., 2009), the PE teachers may be influenced by a certain understanding of demonstrations in PE. The PE teachers may belief that movements and techniques have to be demonstrated by themselves. Physical demonstration by the teacher may be the preferred method of instruction by PE teachers. Although demonstrations are an essential skill that PE teachers should master (Bailey, 2001), too much emphasis on this skill may lead to an implicit disregard against any other modes of demonstration, including ICT use. Nevertheless, there is clear evidence in the literature that video can be of assistance in motor skill learning in PE (O'Loughlin, Ní Chróinín, & O'Grady, 2013).

The results for the subjective theory SO3 ("Letting students work with a laptop in PE fosters their ability to work in a team (collaboration, communication in groups.") varies as well. The PE teachers may have the prejudiced image of the isolated media-addicted youth sitting alone in front of a computer (Holmes, 2012). Therefore, the PE teachers may interpret laptop work not as a collaborative, social activity but as an isolated individual task. The study by Trimmel and Bachmann (2004) showed that laptop classes didn't enhance social intelligence, whereas a study review by Fried (2008) highlighted the positive effects of laptop use on student learning. However, there are multiple pedagogical arrangements provided in the literature to design collaborative laptop uses in classrooms (Koschmann, Kelson, Feltovich, & Barrows, 1996). Using laptops providing a collaborative feedback scenario in PE is also described by Kretschmann (2010). The integration of laptops in stationary group work is also recommended in another scenario.

The analysis of the subjective theory SO4 ("Using ICT in PE facilitates collaboration among teacher colleagues.") lead to mixed results. On the one hand, teachers mostly regard themselves as isolated entities that usually don't collaborate with colleagues if not forced by external authorities (DuFour, 2011). However, there is evidence of a beneficiary informal collaboration among teachers regarding technology (Stevenson, 2005). For PE teachers, the same tradition of isolation can be stated, though there is a strong development of establishing communities of practice from a professional development perspective (Tozer & Horsley, 2006). PE-focused collaborations between schools and regional communities (France, Moosbrugger, & Brockmeyer, 2011) as well between PETE programs and schools (Parker, Templin, & Setiawan, 2012) are documented in the literature. This study only covered "physical" collaborations at the PE teachers' local school. Nevertheless, long-term collegial interaction was identified as a factor influencing technology use in schools (Mumtaz, 2006). However, there is a huge potential for collaboration and sharing experience using "virtual" online channels such as mailing lists (Pennington & Graham, 2002; Pennington, Wilkinson, & Vance, 2004) or social networks (Sezen Balcikanli, 2012). For such online opportunities, the results for the subjective theories SO6 ("A webpage for our PE classes would be useful."), and SO8 ("Internet forums are helpful for PE teachers located at various schools to communicate and compare notes.") vary as well. Although there are plenty of resources hinting at offerings on the Internet (Elliott et al., 2007; Mohnsen & Roblyer, 2013), the PE teachers were undecided whether to use them or not.

The subjective theory SO5 ("Using ICT in PE frequently makes the personal teacher-student relationship suffer.") mirrors a common teachers' belief that using ICT in the classroom would decrease teacher-student interaction. On the contrary, a study by Tanui, Kiboss, Walaba, and Nassiuma (2008) reported that there was no significant change in teacher behavior according to teacher-student interaction and student-student interaction. Furthermore, pedagogical models for ICT integration in the classroom emphasize a supportive teacher-student relationship (Webb, 2013), and definitely don't intend to change teacher-student interaction in a bad way.

Innovative and Modern Teaching-Related Subjective Theories

The subjective theories I1, I3, and I5 came up with mixed results. These subjective theories were all asking about an understanding of teaching in PE that naturally and mandatory includes technology. The PE teachers show diversity in regard to this innovative teaching philosophy. PE teachers may struggle in how to relate ICT to their teaching philosophy, as this struggle is also documented in other subject teachers (King, 2012). Humphries, Hebert, Daigle, and Martin (2012) developed a technology-related subscale for assessing PE teaching efficacy. In relation to this study, the technology-related aspect of PE teachers' teaching efficacy may also stand for the technology-related part within the PE teachers' teaching philosophy. Thus, it may be inferred that an increase of the PE teachers' technology-related teaching efficacy may as well lead to an enhanced technology-related PE teaching philosophy. Mears (Mears, 2009a) appealed for more tech-savviness in PE teachers.

The mixed results for the subjective theory I5 ("The importance of ICT in PE will increase in the future.") may be caused by the interrelation between the uncertainty of possible PE futures, the PE teachers' personal teaching philosophy and subject understanding, and the upcoming instructional technology developments (Finkenberg, 2008; Sanders & Witherspoon, 2012). The subjective theory I6 ("ICT can't replace traditional teaching and learning methods, but complement and accompany it successfully.") may be affected by the same interrelation, though may be also referring to a general (positive or negative) ICT in PE-bias.

The subjective theory I7 ("I frequently heard from other schools' PE teachers that they use ICT in their respective PE classes.") is related to the subjective theory SO4. The negative trend in the results for I7 may be explained by either non-existent occasions sharing information among PE teachers from different schools and/or by mere non-existent implementation of ICT in PE among PE teachers from different schools.

Despite the varying results for the subjective theory I4 ("ICT should play a bigger role in physical education teacher education programs."), a decent amount of the PE teachers (40%) were in favor of infusing PETE programs with ICT. This positive trend is also mirrored by PETE literature (Ayers & Housner, 2008; Bechtel, 2010; Hetland & Strand, 2010; E. M. Jones, Bulger, Illg, & Wyant, 2012; Kretschmann, 2010; Leight & Nichols, 2012).

Gender and Subjective Theories

Statistically significant gender differences in the PE teachers' subjective theories only showed in personal- or interpersonal-related subjective theories, whereas the teaching-related, equipment-related, and classroom management and organization-related subjective theories didn't show statistically significant differences. As the

empirical evidence for PE teachers in regard to this aspect is very limited, also studies with PETE student group focus are considered for the discussion in this case.

Studies that featured gender differences in PE teachers or PETE students, and ICT reported varying results. Bebetsos and Antoniou (2009) found no gender-related differences in PETE students according to attitudes towards ICT and computer use. For other subject teachers, Dogan (2010) also found no significant gender differences in the teachers' perceptions about the use of educational technologies. Moreover, Bakr (2011) didn't find statistically significant gender differences in regard to attitudes towards computers in education among Egyptian teachers.

On the contrary, C. Yaman (2008) found that female PE teachers use technologies, and technology-related learning and teaching methods such as educational games ($p=0.043$), practice ($p=0.003$), and a behavioral approach ($p=0.004$) meaningfully more than male ones. As practice and behavioral approaches may refer to a personal teaching philosophy and/or a either positive or negative ICT in PE-bias, C. Yaman's results also confirm the gender differences in this study for the subjective theories TE7, SO7, I4, and I5. The results for the subjective theory M1 ("I do not have sufficient experience to integrate ICT in PE.") contradict C. Yaman's report for educational games, as in this study, female PE teachers believe to be less ICT competent, whereas in C. Yaman's study, it is the other way round.

In the study by Goktas (2012), most of the assessed attitudes in PETE showed statistically significant differences. The PE teachers attitudes towards technology may be interpreted as directly connected to the PE teachers' personal teaching and subject philosophy in regard to technology. Therefore, the reported gender differences in Goktas' study are in line with the results of this study regarding statistically significant gender differences for the subjective theories TE7, M1, M4, SO7, I4, and I5. However, the attitudes in Goktas' study only tackled computer-related attitudes explicitly, leaving other ICTs out of the discussion.

As gender differences in attitudes and beliefs of non-PE school subject teachers are common in various studies (Gansmo, 2009; Jamieson-Proctor & Finger, 2006; Kibirige, 2011; Prestridge, 2012), it comes to no surprise that PE teachers share similar differences in their subjective theories about ICT in PE.

Computer Literacy and Subjective Theories

The comprehensive computer literacy level results are similar to the findings in other PE teachers-related studies (Gibbone et al., 2010; Woods et al., 2008; C. Yaman, 2008; M. Yaman, 2007b) and other subject teachers-related studies (Konan, 2010; Ocak & Akdemir, 2008; Oluwatayo, 2012). Therefore, this study's sample of PE teachers is neither a low nor a high computer literacy level loaded sample and doesn't contain a computer literacy bias.

Although other studies stated that PE teachers' computer literacy influences their attitudes towards technology in PE (Gibbone et al., 2010; Ince et al., 2006; Woods et al., 2008), this study's results only showed a small number (13 out of 64) of PE teachers' subjective theories about ICT in PE that are statistically significantly influenced by the PE teachers' computer literacy. However, the aforementioned other studies didn't apply inferential statistical procedures and therefore based their judgment rather on rational argumentation.

It comes to no surprise that most of the statistically significant differences according to the PE teachers' computer literacy level popped up in computer literacy-related subjective theories (CL1, CL2, CL3, CL7, CL8, and CL9). This study's results therefore confirm the postulated relationship between PE teachers' computer literacy levels, and certain attitudes and believes of PE teachers' regarding ICT in PE in previous studies (Gibbone et al., 2010; Ince et al., 2006; Woods et al., 2008). This study's results are also in line with the findings in non-PE teachers that also report a statistically significant relationship between teachers' computer literacy, and their attitudes towards educational technology and its integration into classrooms (Albirini, 2006; Cavas, Cavas, Karaoglan, & Kisla, 2009; Ocak & Akdemir, 2008; Ogunkola, 2008; Sadik, 2006).

Household Computer Ownership and Subjective Theories

The small number (5 out of 64) of statistically significant differences regarding PE teachers' computer ownership in relation to their subjective theories about ICT in PE may be unexpected, as computer ownership has been consistently correlated with teachers' beliefs and attitudes towards ICT (Cavas et al., 2009; Ogunkola, 2008; Roussos, 2007). Additionally, in a rather PE-related context, Goktas (2012) found that computer ownership is a significant factor that affects attitudes in PETE students. Hence, it is not surprising that PE teachers' household computer ownership mostly affected the PE teachers' computer literacy-related subjective theories (CL1, CL3, and, CL5) on a statistically significant level.

As every PE teacher in this study possessed at least one computer or laptop, and multiple computer ownership didn't appear as a major factor that influences the PE teachers' subjective theories, previous studies that only focused on a dichotomous computer ownership (0=don't possess a computer; 1=possess a computer) (Cavas et al., 2009; Monk, Swain, Ghrist, & Riddle, 2003; Ogunkola, 2008) may not be taken into account. Whether there is a computer in the household or not, or personal computer ownership is fulfilled or not appear to be outdated questions and codes, as today's (PE) teachers may all posses computers in the meantime. PE teachers may not be as tech-savvy as their students, but at least possess the computer equipment to potentially be.

Nonetheless, some recent research findings in pre-service teachers show a different picture in regard to computer ownership. PETE students (Goktas, 2012) and non-PE pre-service teachers (Zhou, Zhang, & Li, 2011) still don't all own computers themselves. This fact may be explained according to budget issues in the pre-service teacher population. However, (PE) teacher education students do have regular access to computers and ICTs via their university's and study program's ICT infrastructure (Adamakis & Zounhia, 2013; Sharp, 1996; Zhao & Jiang, 2010), compensating for the lack of possessing an own computer. In addition, pre-service (PE) teachers who don't possess a computer will be able to afford an own computer once they become in-service teachers, leaving budget issues behind.

Professional Experience (Years in Service) and Subjective Theories

Only a small number (3 out of 64) of statistically significant differences regarding PE teachers' years in service in relation to their subjective theories about ICT in PE can be reported. This result aligns with the findings by Dogan (2010) that include no difference in teaching experience among non-PE teachers in regard to technology attitudes. Additionally, Gorder (2008) also found no statistically significant gender differences in perceptions based on years of experience in a non-PE teacher population. Furthermore, the temporal stability (Kolbe & Boos, 2009) of the PE teachers' subjective theories is confirmed by the fact that years in service show very small to no impact on the PE teachers' subjective theories.

On the contrary, other studies reported statistically significant relationships and influences between teachers' years in service and attitudes towards technology (Anderson & Williams, 2012; Bakr, 2011; Kahveci, Sahin, & Genc, 2011; Kibirige, 2011). Therefore, it may be inferred that for the population of PE teachers, years in service have a way smaller to no effect on PE teachers' attitudes, beliefs, and subjective theories in regard to ICT in PE.

PE teachers with lesser years in service tended to be more open to the use of ICT in PE depending on ICT availability, as they stated their intention to include ICT in PE if it were available in the subjective theory E5 ("I would absolutely integrate ICT into my PE lessons, if it would be available.").

Years in service showed a reversed effect in the subjective theory CL7 ("I do not use ICT in PE because I am afraid to make a fool out of myself in front of the students."), as PE teachers with a higher amount of years in service were more concerned about their own ICT performance in regard to their reputation with their students. A similar result appeared for the subjective theory CL9 ("My students are better in using ICT than I am."), as PE teachers with a higher amount of years in service have a stronger believe that their students have a higher ICT competence level than they have themselves. PE teachers' years in service, as they stand for age and teaching experience as well, mainly influenced the PE teachers' computer literacy-related subjective theories. This result is expected, as older teachers usually show less computer literacy compared to younger teachers (Asan, 2003; Cavas et al., 2009).

This study's results in the PE teachers' professional experience (years in service) and subjective theories indicate that this study's sample may have a technology-related bias indeed. Taking the interpretations on the above reported results on various aspects of the PE teachers' subjective theories in this study in consideration, a possible negative bias regarding technology use in PE becomes more likely and can therefore be assumed at this point of analysis and interpretation.

LIMITATIONS

This study's sample size (n=57) can't be regarded as a representative sample size, as it is too low compared to the basic population of PE teachers. In addition, PE teachers appeared to be a group that is hard to research, as the participation (questionnaire return rate=47.5%), interest, and turn around time slowed down the data collection process. Another population-based hinderer for larger sample sizes appears in the fact that very numerous schools would have to be involved in data collection, as only a few PE teachers are employed at a single school. However, the other studies that examined PE teachers in this field didn't have large sample sizes either. Ince et al.'s (2006) study included a total of 47 PE teachers, whereas only 19 PE teachers were assigned to the experimental group. Gibbone et al.'s (2010) study included a total of 92 PE teachers, Kretschmann (2012)

and Woods et al. (2008) both investigated a total of 114 PE teachers, M. Yaman (2007b) included a total of 186 PE teachers, and C. Yaman's (2008) study sample contained a total of 191 PE teachers. Comparing this study's sample size to these other studies' sample sizes, this study's sample size is a rather smaller one, but seems to be appropriate to produce significant and valid results. As PETE students are an easier to access population than PE teachers are, sample sizes in ICT-related studies in that population are significantly higher. For instance, Goktas' (2012) sample counted a total of 154 PETE students, the study by M. Yaman (2007a) contained a total of 159 PETE students, and the study by Adamakis and Zounhia (2013) even featured a total of 313 PETE students.

The study's data collection took place in a single area code (area code of Stuttgart, Germany). Therefore, a regional bias may exist. Referring to Dogan (2010), it can be concluded that regional confounders have to be taken into consideration when interpreting findings regarding teachers and PE. Howley, Wood, and Hough (2011) reported that teachers in rural areas showed greater positive attitudes towards technology. Additionally, as schools themselves are a factor of teacher's technology use in classrooms (Afshari et al., 2009), their location and regional idiosyncrasies might as well influence (PE) teacher's beliefs, attitudes, and subjective theories about ICT. Institutional influences on teachers' perceptions are also highlighted in a recent study by Perrotta (2013).

As this study's focus group consisted of secondary school PE teachers only, this study's results may also be limited to this certain grade level and/or school type. Moreover, there is evidence for school levels being a confounder in ICT attitudes of teachers. In a survey of 500 teachers that included different school types (elementary, intermediate, and secondary school), intermediate and secondary school teachers showed significant differences in their attitudes towards e-learning (Aldhafeeri, Almulla, & Alraqas, 2006).

The "if-then" argumentation is regarded as essential as well for "objective" scientific theories and subjective theories, providing an explanation of reality and actions within the real world (Casella, 2012; Groeben & Scheele, 2000). However, not all featured subjective theories in this study were modeled into an if-then phrased questionnaire item. This strategy was chosen in order to widen the potential implications in the study's field of PE teachers and PE. A narrow focus, only using if-then phrases, would have limited the study's scope and wouldn't have mirrored the group discussion's results appropriately. Furthermore, subjective theories have been successfully modeled into non-if-then items in quantitative research before (Müller et al., 2008).

As mentioned before multiple times, the sample may be biased regarding technology use in PE and/or in general. On the one hand, prior studies in PE teachers (Gibbone et al., 2010; Thomas & Stratton, 2006) and PETE students (Goktas, 2012) reported rather positive attitudes towards ICT in general. In addition, most teacher-focused studies showed general positive attitudes towards ICT in educational settings (Charalambous & Ioannou, 2008). On the other hand, M. Yaman (2007a) and Kretschmann (2012) mentioned a negative tendency of PE teachers in terms of routing against ICT in PE. Nevertheless, research has shown that there is evidence of a significant resistance of teachers to using ICT in educational settings (Jamieson-Proctor, Burnett, Finger, & Watson, 2006). For instance, a fifth of a European teachers sample expressed significant skepticism regarding ICT in schools, as they didn't see "significant learning benefits for pupils" (Korte & Hu sing, 2007). There is also evidence of levels of either "technological affinity" or "technological aversion" in teachers (Kahveci et al., 2011), making an argumentation for a sample-specific bias even more plausible. According to Kretschmann (2012), there may also be a country-specific bias distinguishing German PE teachers from other countries PE teachers. Verifying this thought, there is a huge gap between the number of ICT-related publications in PE-related research and practice journals from Germany compared to the ones from the United States (US), leaving the US publication output roughly ten times higher ahead.

IMPLICATIONS

Previous research on the PE teachers' perspective, including this study, hasn't distinguished between the multiple ICTs available. As the technological development is vividly rapid in its nature, the latest devices and software are also heading into educational uses in the PE setting (Papastergiou, 2010). There is not much to no empirical evidence available on the differences or similarities of PE teachers' views on diverse hardware, software, and their application in PE, although there are plenty of suggestions for PE uses available. For instance, physical measurement devices such as heart rate monitors (Nichols, Davis, McCord, Schmidt, & Slezak, 2009) or pedometers (Cagle, 2004; Pangrazi, 2004), geocaching (Elwood Schlatter & Hurd, 2005), wikis (Hastie, Casey, & Tarter, 2012; Mears, 2009b), social media platforms (Kaluf, 2012), podcasts (Mears, 2009b; Mikat, Martinez, & Jorstad, 2007; Shumack & Reilly, 2011), apps (Cummiskey, 2011), and exergaming (Ennis, 2013; Hicks & Higgins, 2010) are prominent features in recent PE practice literature. The PE teachers' opinions on the use and value in PE for each of these ICT assets may differ as well as its diverse applications.

Previous studies indicated that teachers' beliefs about ICT in the classroom differ from their actual use in the classroom (Ertmer, Ottenbreit-Leftwich, Sadik, Sendurur, & Sendurur, 2012). The same mechanism may be assumed as well for PE teachers. Positive attitudes and proficiency in ICTs don't grant wide and rich ICT integration (Bauer & Kenton, 2005). Thus, the relation of PE teachers' view on using ICT in PE and their actual ICT use in PE is still in need to be shed light on. Furthermore, there is no evidence available about the potential change of PE teachers' teaching methods and styles when integrating ICT compared to traditional non-ICT-integrating PE. However, non-PE teachers were likely to sustain and didn't change their existing patterns of teaching practice when integrating technology in their classes (Cuban, Kirkpatrick, & Peck, 2001).

Tsitouridou and Vryzas (2004) reported that teachers perceive technology adoption as an important strategy for improving educational practices. Although there is evidence for a positive relation between teachers' general pedagogical beliefs and their technology use in classes (C. P. Lim & Chai, 2008; Sang, Valcke, van Braak, & Tondeur, 2010), this relationship may or may not be a direct one (Chai & Lim, 2011). However, teachers showing positive views on potential ICT benefits in educational settings may not perceive themselves having sufficient computer literacy (Gulbahar & Guven, 2008), and may show a difference between ICT literacy and pedagogical ICT competence (Banaji, Cranmer, & Perrotta, 2010). Considering these results, there may also be significant differences between general pedagogical beliefs and subjective theories regarding ICT in education, and regarding ICT in PE in the PE teacher population.

Kretschmann (2010, 2012) postulated PE teacher continuing education and PETE being amongst several developmental areas in the field of technology and PE research. Although there are some suggestions for infusing PETE programs with technology available in recent publications (Ayers & Housner, 2008; Baert, 2012; Bechtel, 2010; E. M. Jones et al., 2012; Leight & Nichols, 2012; Mitchell & McKethan, 2003), evaluations using scientific research methodology haven't been performed and/or made public yet. Additionally, trainings on ICT use in PE for in-service PE teachers haven't been in the focus of PE teachers-related publications so far, although there is plenty of research available for teachers of other subjects (Batane, 2004; Guzman & Nussbaum, 2009; Jung, 2005), as teacher trainings focusing on ICT are regarded as a major factor of ICT implementation in schools (Afshari et al., 2009).

PE teachers may be regarded as a special population among school teachers. PE is the only school subject that explicitly has physical activity as teaching and learning content and method (National Association for Sport and Physical Education (NASPE), 2004). Therefore, teaching philosophies and ideologies of PE teachers may be different from other subject teachers, especially in regard to ICT integration (Kretschmann, 2010). Comparing PE teacher populations with non-PE teacher populations might reveal interesting insights according to the teacher's perspective on ICT use in PE and in the classroom. For instance, constructivist approaches have been prominent in PE research (Wallian & Chang, 2007; Wright, Grenier, & Seaman, 2010; Zhu, Ennis, & Chen, 2011), though not in relation to ICT use in PE. General studies in teaching methods showed that teacher beliefs grounded on constructivist approaches had an impact on using ICT for creative thinking and learner-centered activities in the classroom (Prestridge, 2012). This relationship hasn't been investigated for PE so far. As suggested by Kretschmann (2012), there may be two dichotomous poles, separating PE teacher's approaches to ICT in PE. Roughly speculated, there may be PE teachers who naturally adopt and integrate ICT and PE, opposing PE teachers that decline any use of ICT in PE.

Tondeur, Devos, Van Houtte, Van Braak, and Valcke (2009) found that schools having better structural and cultural characteristics had a higher frequency of ICT use. ICT use is therefore also majorly affected by the supportive organizational culture and a collegial work environment (Deaney & Hennessy, 2007). It is likely that not only the actual school' ICT culture and ICT availability, but also the (PE) teachers perceptions of them, influence ICT use in classes. Despite diverse discussion and debate about PE and school culture (Ennis, 2006; Medcalf, Marshall, Hardman, & Visser, 2011; Tripp, Rizzo, & Webbert, 2007), ICT hasn't played a role within this discussion yet.

Whereas this study tackled the PE teachers' perspective, the students' view on ICT and PE is just as important, as they are the recipients of any educational effort. Overall, students' view on ICT is to be regarded as quite positive, both in relevance in the leisure and professional domains (Sharpe, 2004a, 2004b). Various findings from multiple disciplines and subjects show positive opinions and appreciation of ICI adoption in ICT-enhanced classes for various ICT assets such as multimedia and whiteboards (Hall & Higgins, 2005), or technology in general (Becker & Maunsaiyat, 2002; Kubiatko, Halakova, Nagyova, & Nagy, 2011; Yu, Lin, Han, & Hsu, 2012). The students' perspective of PE has been researched in-depth (Bernstein, Phillips, & Silverman, 2011; Dyson, 2006; Rikard & Banville, 2006), though not with any emphasis on ICT in PE yet. Hence, a future research question may sound like this: "What do PE students think about integrating technology into PE?"

This study has shed some more light on the PE teacher's perspective on ICT in PE. But the lack of empirical research findings in the area of technology and PE that was stated by Kretschmann (2010; 2012) can still be confirmed. Therefore, more empirical research efforts should be made in this area. In conclusion, a statement by Goktas (2012) can be repeated: "Further studies are needed in the same area using different samples so that more valid and reliable conclusions may be drawn."

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