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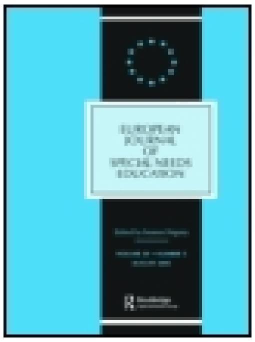

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ARTICLE

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Teachers' preparedness to deliver remote adapted physical education from different European perspectives: Updates to the European Standards in Adapted Physical Activity

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ABSTRACT

When schools were closed due to the COVID-19 restrictions, teachers were challenged to engage children with Special Educational Needs (SEN) through remote teaching, particularly in physical education. The European Standards in Adapted Physical Activity (EUSAPA) have been used to define the competencies of adapted physical education (APE) teachers. Through a consensus building exercise, the standards were updated in this paper to include technologically supported pedagogy. Evidence from 125 APE teachers, who completed a technological communication inventory, modified versions of the technology, pedagogy and content knowledge scale (TPACK-21), and self-efficacy on including students with disabilities in physical education scale (SE-PETE-D), were used to inform experts to create technological indicators for the EUSAPA. Teachers used 3 to 4 technologies (email, phone, SMS, Whatsapp) to communicate with students and colleagues, and many reported low levels of technological content knowledge. Experts considered the need to add 13 new functions to the EUSAPA. Most of the functions were considered to be feasible to implement in existing practices and the other requiring extra resources or skills. As further training is planned, consideration of expertise is warranted when mapped against meeting standards.

KEYWORDS

COVID-19; TPACK; self-efficacy; homeschooling; special education; technological content knowledge

Introduction

In the spring of 2020, the fast spread of the novel coronavirus COVID-19 led to rapid actions around to the world to limit the spread of the virus, including the closure of schools (Viner et al. 2020). In April 2020, educational institutions were closed in 186 countries, affecting approximately 74% of total enrolled learners on the planet (World

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This article has been corrected with minor changes. These changes do not impact the academic content of the article.

Bank 2020). Ministries of Education across Europe had to make rapid decisions on comprehensive emergency remote teaching solutions to support school administration, teachers, parents, and students in this challenging period (European Centre for Disease Prevention and Control, 2020). The circumstances from school closures were novel, leading to many unanswered questions concerning teacher preparation and professional skills for teaching remotely (Giovannini et al. 2020), especially students with special educational needs (SEN).

In a recent study of 4859 respondents, the majority of teachers (67%) had taught online for the first time when schools were closed due to COVID-19 restrictions (School Education Gateway 2020). Teachers faced tremendous workload in the first few weeks of school closures, as the announcement was abrupt, forcing teachers to move their teaching content online as well as attempts to navigate around the technology to make teaching possible (Allen, Rowan, and Singh 2020). Teachers also experienced difficulties accessing computers, software, and internet connections (School Education Gateway 2020). As such, there is a great need to collect data on teachers professionalisation to meet these challenges and ideally this information must be translated into action.

Challenges are at the student level too, whereby inequalities in learning are exacerbated by differences in access to digital technologies at home (United Nations 2020). Given that between 15–20% of households in Europe were without access to the internet, online only solutions to remote schooling were not feasible (Giannini 2020). Therefore, multiple modes were made available, such as, one in five countries used radio, two thirds use television, and 80% used online distance learning solutions (UNESCO 2020a). Despite this flexible approach, fewer students than normal were in contact with their teachers on a daily basis (Huber and Helm 2020).

The sudden and dramatic changes from normal routines, can create further anxiety and restlessness for some students with SEN (Lee 2020). Research studies have found that students' isolation or quarantine periods during various epidemics were associated with increased distribution of acute stress disorder, behavioural and psychological problems creating more challenges for teachers (Sprang and Silman 2013). Teaching when the schools were closed put students with SEN at a further disadvantage, with insufficient differentiation by teachers in classes (Letzel, Pozas, and Schneider 2020). The lack of professional assistants typically in a class is an extra consideration to the teacher, as well as social and cognitive presences necessary for online teaching (Carrillo and Flores 2020).

There are varying practices for special education across Europe (European Agency for Special Needs and Inclusive Education, 2019). For example, Lithuania and Latvia still follow the two-track education model: (1) special and (2) inclusive education. Although European and international legislation on education states that every child has the right to be educated in a school of their parents' choice, in reality, not all mainstream schools can provide the necessary support and learning environments to meet the needs of children with SEN, particularly in school-based or after-school physical activity (Klavina et al. 2017). To avoid further exclusion of students with SEN, physical educators had to come up with innovative ways to provide APE in a meaningful and safe way during lockdown (Fitzgerald, Stride, and Drury 2020). These innovations often require competencies in using technology to support students with SEN (Ng 2020) and would supplement the expected responsibilities of APE teachers: ensure the safety of students, conduct practical and theoretical assessments, manage the behaviours of students, be knowledgeable on the differences in applying physical education based on functional difficulties, as well as working with assistive technologies (Lytle, Lavay, and Rizzo 2010).

A common framework for APE can be found from the European Standards in Adapted Physical Activity (EUSAPA; Kudlacek, Morgulec-Adamowicz, and Verellen 2010) which describes professional competencies in four sections, A – teacher planning, B – inclusion teaching, C – evaluation of students, and D – professional collaborations. When the standards were created, the use of technology was not as pronounced in APE as it is currently (Gawrisch, Richards, and Killian 2020). Concepts included in the Technology, Pedagogy, and Content Knowledge (TPACK) framework, particularly technological pedagogical innovation have increased rapidly in the past decade. TPACK measures have been used to assess modern training needs of physical education teachers as technology is integrated into pre-service training (Cengiz 2015). Yet, knowledge about TPACK for existing physical educators is lacking. Teachers' experiences from school closures due to COVID-19 restrictions created an authentic experience for teachers to relate and accurately respond to items in the areas of TPACK.

To the authors' knowledge, no studies have been conducted regarding physical educators' skills for remote teaching students with SEN during the COVID-19 restrictions. Hence, the purpose of this study is to 1) gain insights into the use of technology in APE during COVID-19 restrictions, 2) to provide an upgrade to the educational aspects of EUSAPA, by investigating domains of TPACK 21st Century skills, and 3) how these may fill gaps in the existing set of standards.

Methods

In this study, we followed the consensus statements process outlined by Breart et al. (1990) where the process must include (1) scientific evidence, (2) panel members use the evidence, and (3) the environment permitting updates. To meet the final aim to update the EUSAPA education domain we sought out TPACK domains. In the first phase of consensus statement development, we could not seek out existing literature as school closures as part of lockdown was a completely new experience among this generation of teachers. To gather evidence, we administered questionnaires to second level physical education teachers in special education settings across Europe to find out their experiences of using technology to teach physical education in special education under the extreme circumstances of the COVID-19 lockdown. In the second phase, four experts in academia with extensive experience in APE examined EUSAPA and identified gaps where technology should be included in the standards, and the feasibility of it being operated as an additional standard. In the final phase, we combined both quantitative data from the surveys with the experts' work on EUSAPA to create an action plan for updating the educational domain of EUSAPA to a localised context.

Phase 1 – Evidence gathering through surveys

Participants

A convenient sample of second level physical education teachers in Europe (i.e., France, Ireland, Latvia, Lithuania, Portugal and the United Kingdom) was recruited to take part in a study about the use of technology for physical education for students with SEN during COVID-19. At the time of data collection, schools were reopening from lockdown mode (France, Portugal), or had already entered summer vacations (Ireland, Latvia, Lithuania, United Kingdom) (World Bank 2020). National teacher associations were contacted in each of the countries as well as postings on social media channels. The survey was online only, and a universal link with language selection was made available. Translation of the instruments was carried out in each country for those not already available. Each language pack was tested by a translator with APE expertise, and back translated to ensure consistency of the items between the original and the translated version. Respondents gave their active consent to take part in the study voluntarily. Due to the non-invasive nature of the study through surveys, this type of data collection did not require institutional ethical approval from the lead author's ethics committee. Nevertheless, the participants were assured their data was confidential and anonymised during data analyses.

Instruments

Background variables. Respondents reported their gender, age, and the type of school they work in (i.e. general school, special school classes in general school, or special education schools). For the purpose of analyses, special classes and special schools' teachers were combined to highlight differences in teaching in a segregated or an inclusive class setting.

Based on a cut-off value of seven years teaching experience (Kini and Podolsky 2016), two items, (1) the number of years of special education teaching experience and (2) indication of formal qualification training in special education were combined to form (a) untrained novice, (b) intermediate (untrained and experienced, or trained but no experience), and (c) expert professionals. Respondents were asked to report different technologies (i.e. Email, Microsoft Teams, Skype, WhatsApp, SMS, Phone, Zoom and Learning management system) used to communicate with students and colleagues on a daily basis. These technologies were counted together to provide the number of different communication channels used for remote teaching during lockdown.

TPACK 21st century physical education

The TPACK 21st Century skills (TPACK-21) has seven subscales that cover the different areas of (1) pedagogical knowledge, (2) technological knowledge, (3) content knowledge, (4) technological pedagogical knowledge, (5) pedagogical content knowledge, (6) technological content knowledge, and (7) technological pedagogical and content knowledge. Each item has a six-point response scale ranging from '1' representing 'I need a lot of additional knowledge about the topic' to '6' representing 'I have strong knowledge about the topic' (Valtonen et al. 2015). The original items were modified from knowledge in 'natural sciences' to 'physical education for students with special educational needs' (i.e. TPACK-21-PE).

Self-efficacy PE teaching with children with disabilities

The Self-Efficacy Scale for Physical Education Teacher Education Majors towards Children with Disabilities (SE-PETE-D) was used to evaluate teachers' perceived self-efficacy (Block et al. 2013). A vignette approach was used for 11 items for teaching students with intellectual disabilities, 12 items for students with physical disabilities, and 9 items for teaching students with visual impairments. The terminology used in the original text 'disability' was based on the context of schools in the USA. For the purpose of this study, we refer to these items as specific intellectual (IEN), physical (PEN) or visual (VEN) educational needs. Response options were on a five-point confidence Likert scale, ranging from '1' ('no confidence') to '5' ('complete confidence').

Data analysis

Frequencies of background variables were tested against the different levels of experiences through the Chi-square test of independence. Initially, mean scores of individual items of TPACK-21-PE were reported to demonstrate particular aspects of TPACK. Subsequently, items were grouped in their factors as proposed by Valtonen et al. (2017) and Block et al. (2013) for TPACK-21, and SE-PETE-D, respectively. Cronbach's alphas were noted for each of the seven scale items. Mean scores of each factor were adjusted by teacher gender and the type of school after stratifying by teaching experience. Z-scores were created for each variable so that univariate tests could be performed with standardised coefficients. Differences between teaching experience were determined through one-way ANOVA for each factor. Practical significance is reported as partial eta-square ($\eta\rho^2$), as a measure of effect size for mean differences with the following interpretation: >0.26, between 0.26 and 0.02, and <0.02 were considered as large, medium and small, respectively (Pierce, Block, and Aguinis 2004). These analyses were performed to highlight differences in experiences so that enactment of highlighted standards could be tailored to meet the level of experience of the teacher. Data was analysed using the Statistical Package for Social Sciences (version 24.0 for Windows, SPSS Inc, Chicago, IL, USA). Statistical significance was set at an alpha level of $p < 0.05$.

Results

PHASE 1 – Descriptive results. A total of 125 teachers completed the survey in French (n = 9), English (n = 20), Latvian (n = 39), Lithuanian (n = 25), and Portuguese (n = 32) languages. One in four (26%) of the respondents were novice teachers, over a third (38%) intermediate and the remaining (36%) expert teachers. The majority of teachers were female (57%), over 40 years old (71%) and taught in general school settings (59%). Experiences of teaching children with IEN was reported the most (88%), followed by PEN (85%) and fewer teachers (53%) had experiences with working with VEN students. (Table 1).

Almost all teachers used email (94%), phonecalls (80%) and SMS (70%) daily to students or colleagues. Many teachers used WhatsApp (62%) and Zoom (63%) daily, with half (51%) of teachers reported to use a learning management system (LMS), and 41% reported use of Teams. Technologies were often used for communicating with both students and colleagues as depicted in Figure 1 with LMS the most common method for sole interaction with students and not colleagues. The average number of forms of communication with students was 3.6 (SD = 1.8) and with colleagues was 4.6 (SD = 1.8), and they did not differ based on teacher experience level.

Table 1. Study background demographics by Expertise level.

	Total	Novice	Intermediate	Exper	p
N	121	31	46	44	
Gender					
Male (%)	43.0	45.2	32.6	52.3	0.160
Female (%)	57.0	54.8	67.4	47.7	
Age Group					
18 29 yr. (%)	9.8	12.9	14.9	2.3	0.010
30 39 yr. (%)	18.9	25.8	27.7	4.5	
40 49 yr. (%)	36.9	29.0	31.9	47.7	
50 59 yr. (%)	34.4	32.3	25.5	45.5	
School Type					
General	59.0	58.1	66.0	52.3	0.410
SECS	41.0	41.9	34.0	47.7	
Experience in teaching students with Intellectual Disability					
No Experience	12.1	23.3	11.1	4.9	0.060
At least once	87.9	76.7	88.9	95.1	
Physical Disability					
None	15.5	20.0	22.2	4.9	0.063
At least once	84.5	80	77.8	95.1	
Visual Disability					
None	47.4	60	46.7	39.0	0.215
At least once	52.6	40	53.3	61.0	
Communication methods	Mean (SD)	Mean (SD)	Mean (SD)	Mean (SD)	p
With students	3.6 (1.8)	3.5 (1.9)	3.7 (1.8)	3.6 (1.8)	0.887
With staff colleagues	4.6 (1.9)	4.4 (1.6)	4.7 (2.1)	4.7 (1.9)	0.802

SECS = special education classes in general school, or special education schools

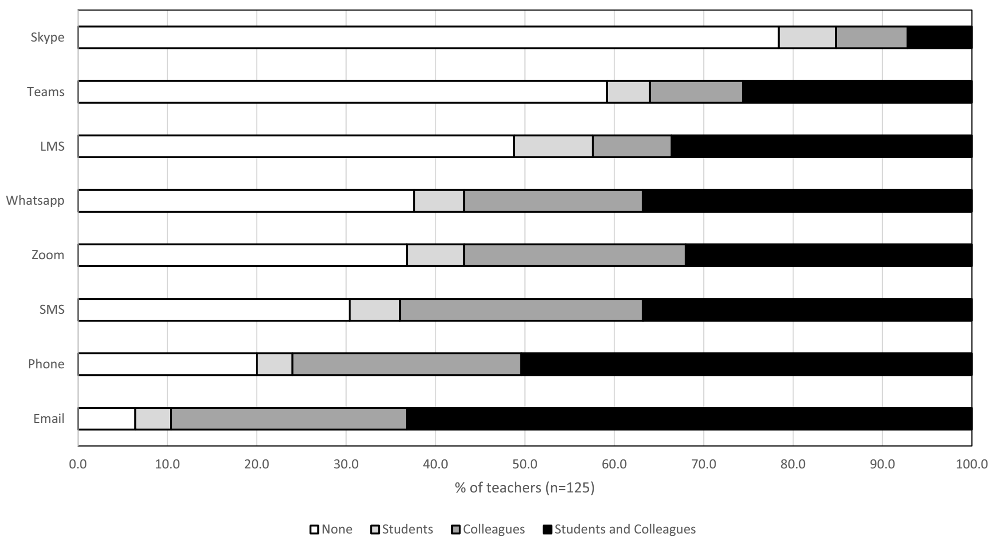

Figure 1. Distribution of types of daily technology use by teachers with students and colleagues during COVID-19 restrictions.

Comparisons based on teaching expertise

The unstandardised mean scores for each factor are reported in Table 2. In addition, the Cronbach's alpha is reported for each factor. After adjusting for teacher's gender and

Table 2. Subdomains unstandardised means and standard deviations with cronbach's alphas.

	Mean	SD	alpha
Parent 1 Interaction	10.85	3.55	0.81
Parent 2 Involvement	10.15	3.06	0.72
Parent 3 Relationship	16.51	3.55	0.74
Parent sum			0.86
PK	42.58	9.24	0.93
CK	14.93	5.05	0.91
TK	16.53	4.19	0.86
PCK	32.75	11.27	0.97
TCK	12.74	4.99	0.93
TPK	37.88	11.56	0.98
TPACK	23.91	9.13	0.98
TPACK sum			0.98
IEN Efficacy	40.02	10.11	0.98
PEN Efficacy	42.61	11.55	0.98
VEN Efficacy	30.59	11.59	0.99
Self-Efficacy sum			0.98

SD = standard deviation; PK = pedagogical knowledge; CK = content knowledge; TK = technological knowledge; PCK = pedagogical content knowledge; TCK = technological content knowledge; TPK = technological pedagogical knowledge; TPACK = pedagogical technological content knowledge; IEN = Intellectual educational needs; PEN = physical educational needs; VEN = visual educational needs

school type, there were no statistical differences in the standardised scores of SE-PETE-D for IEN, PEN, or VEN (Table 3). CK scores were greatest for experts and the differences between the groups were statistically significant in the CK ($p = 0.001$; $\eta\rho^2 = 0.17$, medium), PCK ($p = 0.004$; $\eta\rho^2 = 0.15$, medium), TCK ($p = 0.028$; $\eta\rho^2 = 0.10$, medium), and TPACK ($p = 0.015$; $\eta\rho^2 = 0.13$, medium) subscales. This could imply that CK is largely formed from the combination of both years of experience as well as formal training. Differences in other factors from TPACK-21-PE were not statistically significant.

Differences among single items

There were statistically significant differences among many items related to the content knowledge subscale, except for CK4 and TCK4 (Table 4). From the pairwise comparisons the main differences existed between expert and novice physical educators. Experts had higher scores than intermediate teachers in TPACK #4 ($p = 0.014$), #6 ($p = 0.033$), and #7 ($p = 0.017$). Other than content knowledge, other items in the TPACK-21-PE, such as TPK #6 ($p = 0.004$) and #8 ($p= 0.007$) were greater among experts than intermediate or novice teachers. In other variables, experts reported higher mean scores than novices and intermediate teachers, but the differences between novice and intermediate were not statistically significant.

Phase 2 – Expert panel on EUSAPA

The EUSAPA functional map was examined by four experts in this field. The functional map is broken down into (1) key areas, (2) key roles, and (3) key functions (Kudlacek, Morgulec-Adamowicz, and Verellen 2010) and more information about this can be found from the EUSAPA website (www.eusapa.eu). There were four steps for this phase of the study. In step 1, the experts looked at the original functional map to review the text and its ontology. In step 2, the experts added a column for technology indicators. Each independently added technological indicators seen as needed to

Table 3. Adjusted standardised mean differences of subdomains by expertise.

	Novice			Intermediate			Expert					
	Mean	LCI	UCI	Mean	LCI	UCI	Mean	LCI	UCI	F	p	ηp^2
TPIQ (Parent-Teacher Involvement Questionnaire)												
Parent 1 Interaction	−0.173	−0.577	0.231	−0.101	−0.472	0.271	0.313	−0.050	0.677	1.972	0.146	
Parent 2 Involvement	−0.374	−0.802	0.054	0.173	−0.221	0.566	0.278	−0.107	0.663	2.820	0.066	
Parent 3 Relationship	0.107	−0.324	0.539	0.074	−0.323	0.471	−0.005	−0.394	0.383	0.082	0.921	
PTIQ	−0.164	−0.593	0.264	0.052	−0.342	0.446	0.232	−0.153	0.618	0.951	0.391	
TPACK-21 (TPACK 21st Century skills – Physical Education version)												
PK	−0.202	−0.609	0.205	0.069	−0.285	0.422	0.037	−0.305	0.379	0.557	0.575	
CK	−0.561	−0.914	−0.208	0.126	−0.181	0.432	0.311	0.015	0.607	7.512	0.001	0.171
TK	−0.287	−0.694	0.121	0.200	−0.154	0.554	0.201	−0.142	0.543	2.035	0.138	
PCK	−0.402	−0.732	−0.072	−0.049	−0.360	0.261	0.340	0.054	0.626	5.918	0.004	0.152
TCK	−0.307	−0.694	0.079	−0.101	−0.465	0.262	0.358	0.023	0.693	3.762	0.028	0.102
TPK	−0.264	−0.676	0.148	−0.145	−0.536	0.247	0.193	−0.164	0.55	1.611	0.208	
TPACK	−0.429	−0.824	−0.035	−0.193	−0.583	0.197	0.323	−0.03	0.676	4.474	0.015	0.128
SE-PETE-D (Self-Efficacy Scale for Physical Education Teacher Education Majors towards Children with Disabilities)												
IEN	−0.132	−0.566	0.301	0.108	−0.327	0.543	−0.022	−0.446	0.401	0.280	0.757	
PEN	−0.14	−0.617	0.338	0.008	−0.468	0.483	0.149	−0.333	0.631	0.337	0.716	
VEN	−0.066	−0.527	0.395	−0.054	−0.527	0.419	0.105	−0.332	0.542	0.190	0.828	
Self-Efficacy	−0.157	−0.618	0.303	−0.013	−0.475	0.448	0.120	−0.349	0.589	0.334	0.717	

LCI = lower confidence interval; UCI = upper confidence interval; PK = pedagogical knowledge; CK = content knowledge; TK = technological knowledge; PCK = pedagogical content knowledge; TCK = technological content knowledge; TPK = technological pedagogical knowledge; TPACK = pedagogical technological content knowledge; IEN = intellectual educational needs; PEN = physical educational needs; VD = visual educational needs

Table 4. Differences in TPACK content knowledge single items by teacher experience and post-hoc tests.

			Pairwise comparisons								
Item	F	p	E–N	p		E–I	p		I–N	p	
CK1	4.50	.013	0.98	0.006	*	0.01	0.730		0.86	0.014	*
CK2	9.29	<.001	1.39	<0.001	*	0.54	0.070		0.85	0.009	*
CK3	3.48	.035	0.80	0.017	*	0.07	0.810		0.73	0.029	*
CK4	2.59	.080	0.80	0.034	*	0.12	0.720		0.68	0.070	
PCK1	6.89	.002	1.14	0.001	*	0.12	0.690		1.02	0.002	*
PCK2	4.37	.015	1.09	0.005	*	0.30	0.380		0.78	0.037	*
PCK3	4.98	.009	1.09	0.003	*	0.30	0.360		0.80	0.025	*
PCK4	6.10	.003	1.30	0.001	*	0.54	0.120		0.76	0.040	*
PCK5	4.22	.018	1.02	0.005	*	0.44	0.017	*	0.57	0.100	
PCK6	5.62	.005	1.02	0.005	*	−0.07	0.830		1.10	0.003	*
PCK7	3.85	.025	0.96	0.008	*	0.24	0.460		0.72	0.043	*
PCK8	4.97	.009	1.02	0.005	*	0.10	0.760		0.93	0.009	*
PCK9	3.41	.037	0.87	0.015	*	0.15	0.630		0.72	0.041	*
TCK1	3.83	.025	0.97	0.007	*	0.50	0.120		0.47	0.180	
TCK2	5.15	.008	1.10	0.003	*	0.23	0.490		0.87	0.015	*
TCK3	7.06	.001	1.22	<0.001	*	0.37	0.023	*	0.85	0.010	*
TCK4	.94	.40	0.48	0.350		0.16	0.320		0.32	0.350	
TPACK1	6.14	.003	1.23	0.001	*	0.43	0.200		0.80	0.025	*
TPACK2	4.72	.011	1.07	0.003	*	0.39	0.240		0.68	0.050	*
TPACK3	4.42	.015	1.04	0.004	*	0.39	0.240		0.65	0.070	*
TPACK4	5.98	.004	1.15	0.001	*	0.82	0.014	*	0.33	0.350	
TPACK5	4.58	.013	1.04	0.003	*	0.45	0.170		0.59	0.090	
TPACK6	5.80	.004	1.19	0.001	*	0.73	0.033	*	0.47	0.190	
TPACK7	7.54	.001	1.26	<0.001	*	0.75	0.017	*	0.51	0.130	

CK = content knowledge; PCK = pedagogical content knowledge; TCK = technological content knowledge; TPACK = technological pedagogical and content knowledge; E–N = expert vs. novice; E–I = expert vs. intermediate; I–N = intermediate vs. novice; * $p < 0.05$

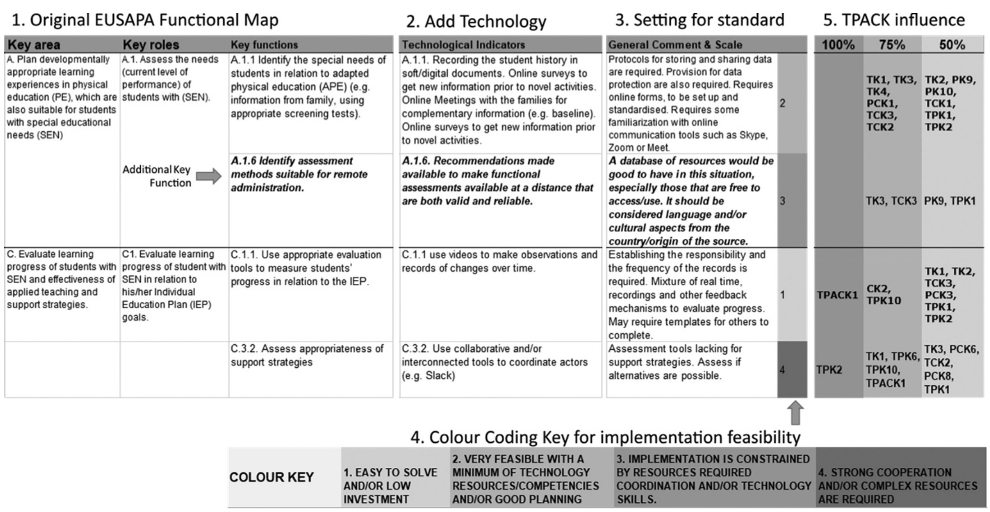

Figure 2. Step-by-step guide for adding communication and information technology indicators to EUSAPA's adapted physical education functional map.

develop the EUSAPA and the inputs were merged. This mapping process led to a discussion between the experts for the inclusion of additional functions. In step 3, each expert was asked to provide comments and information about a scale that could be used to determine the setting for the standard. The experts created an extra column to provide independent supporting details for the implementation and an indicator of readiness. Like step 2, the information was then aggregated. In step 4, the feasibility of the technological indicators was assessed based on how it could be implemented in teaching environments. Each expert reviewed these options; 'easy to solve', 'very feasible with a minimum of technology resources, competencies or planning', 'implementation is constrained by resources, requires coordination or technology skills', and 'strong cooperation or complex resources are required'. The last step (5) by the experts was guided by TPACK domains. The experts were asked to independently examine all the items that appear in the TPACK-21-PE questionnaire and then map how each technological indicator may influence the amount of knowledge in an item. The step-by-step guide of the mapping exercise by the expert panel is in Figure 2.

Results from the expert panel

Experts created 13 new functions in the standards. Of the 51 key functions in the revised EUSAPA APE functional map, 25 were deemed as feasible to implement in the current circumstances. There were 20 functions that the experts felt implementation is constrained by a lack of resources or appropriate skills. A further 6 functions were deemed to be very difficult to implement as strong cooperation or complex resources are required. These included;

A.1.4. Identify perceptions of students with SEN in physical education
B.1.3. Adapting ways to facilitate participation
C.3.2. Assess appropriateness of support strategies
D.2.2. Collaboration with non-governmental organisations
D.3.1. Identify professional development in APE
D.3.4. Self-evaluate, of which, the experts felt should change to 'self-reflection'

The full list of updated standards is freely available on the EUFAPA.eu website (https://eufapa.eu/eupapa/pe-and-sen-during-covid-19/). The experts also identified a new key role with four key functions, B.4 'Apply different teaching strategies to motivate all students' learning'. There was 75% agreement from TPACK on these functions with the majority of items influenced in the pedagogical knowledge domain. Moreover, the perceived implementation was seen as 'very feasible'.

Phase 3 – Final update for EUSAPA education domain

The experts looked at the items from phase 1 to identify pertinent areas from phase 2 to create a final update for EUSAPA education domain. Where items from TPACK-21-PE were similar between teachers, the setting was considered to be universal. Where there were differences, tailored methods for updating continuous professional knowledge were recommended and framed based on the expertise of teachers. Items with low TPACK-21-PE scores were prioritised over high, as these highlighted greater training needs in the immediate setting. In addition, the level of expert agreement of the TPACK-21-PE items was considered, when setting a consensus on how the standards would be used to prepare APE teachers in the future.

Results from environmental setting

The lowest five items from TPACK-21-PE were TCK1, TCK2, TCK3, TPACK7, and TCK4. Under B.3, 'key roles to communicate with students with SEN', a new function was identified as B.3.2 'Use appropriate technologies to illustrate content in physical education for students with SEN'. It was linked to two items in the area of TCK, and three items in the TPK domain. The rating of implementation was 'very feasible' and bringing models of best practice by other teachers together may be a useful resource to increase self-efficacy and quality of PE teaching. Platforms already exist that create a community of practice from social media groups, websites (i.e. www.ifapa.net), video and podcast channels, although language translations could be improved to make such resources reach their potential.

The TPACK1 item appeared the most and appeared in three EUSAPA key areas A – teacher planning, B – inclusion teaching, and C – evaluation of students. The item, 'In teaching PE for students with SEN, I know how to use information and communication technology as a tool for sharing ideas and thinking together' had the lowest scores for novice teachers, and highest for experts, although the difference between intermediate and expert teachers was not statistically significant. As such, the mean score was in the middle when compared with the other items. Moreover, none of the experts believed it was associated with any of the new functions. The assessment on implementation was, on average between 'very feasible' and 'implementation constrained by resources'.

Of the newly created functions from the expert panel, few had 100% agreement with the technological indicators. For example, a new function was labelled A.1.7, based on identifying the most approach strategies for remote teaching. Experts agreed that PCK1 would be influenced by this function. Mean scores from this PCK1 were in the middle from other TPACK-21-PE items, and a medium need was identified. The new function was deemed as a very feasible indicator and it would depend on what hardware and software the majority of European schools have access to.

Another new key function was B.1.5 'Use various technologies to deliver physical education to all students', and this was indicated by the creation of synchronous and asynchronous teaching sessions. It was agreed (100%) that this item would influence TPK1 and TPK10 items. Based on the survey data, this type of knowledge does not differ based on the experience level of the teacher. Moreover, TPK1 had the eighth highest TPACK-21-PE mean score of the 48 items. The level of implementation was ranked as 'very feasible' and with already high scores, this may appear as tacit knowledge for the teachers.

Discussions

In this study, a consensus approach was used to update the educational domain of EUSAPA to reflect more on 21st Century skills, specifically with technological content knowledge. The authors combined the information given by teachers who had to teach PE during the COVID-19 lockdown, with expert consensus in the areas of APE, and then considered the environment to implement such standards. Given the growing need for digitalisation in the workplace, even before COVID-19 (Kluzer, Centeno, and O'Keeffe 2020), we captured rare insights from teachers across Europe who had to rely upon technology to carry out their work. Going forward, pre or in-service teaching training of technology would be added to the original key components (inclusion, capacity building and monitoring) of EUSAPA.

This is the first known study that asked the opinions of APE teachers in Europe during the pandemic. The survey results fill the gap following large surveys such as the School Education Gateway (2020) or the UNESCO-UNICEF-World Bank Survey on National education response to COVID-19 (UNESCO 2020b). Moreover, this study complements the recently published digital competencies readiness framework in Europe (Kluzer, Centeno, and O'Keeffe 2020), schooling going beyond COVID-19 (United Nations 2020) and updates the EUSAPA (Kudlacek, Morgulec-Adamowicz, and Verellen 2010).

During the pandemic, many teachers faced challenges during on-line education for students with SEN because these students were lacking a structured learning environment at home as well as interactions with their peers. Without proper remote teaching delivery, students with SEN would experience distance learning as being 'left on a sideline' (Douat 2020). It does not have to be like that, as strategies that are easy to use and maintain between teachers and students are already available, for example, students or parents logging exercises to an online platform to encourage regular physical activity (Calise et al. 2020). Depending on the lesson, physical education can be designed as synchronous or asynchronous (Varea and González-Calvo 2020), requiring multiple competencies with technology (Ng 2020). The results from phase 1 suggest that hybrid teaching took place during school closures as there was daily communication through three to four different modes (e.g. email, phone, SMS, WhatsApp, etc.). The popular modes are considered as standard communication tools, rather than advanced pedagogical platforms. The growing need for preparing teachers to use the right multiple technologies is evident, as well as preparing for combining online and face-to-face teaching in the future.

Many teachers are unfamiliar with technology in their APE environments, let alone in the remote lesson (School Education Gateway 2020). During the COVID-19 lockdown, teachers realised how important it was to receive training on the use of these online pedagogical tools and how they have been useful to maintain contact and communication with students (Varea and González-Calvo 2020), although more is needed for APE specialists (Fitzgerald, Stride, and Drury 2020). The low scores in TCK areas confirm the lack of preparation teachers have to use technology specifically with their content. This is hardly surprising as the literature on physical education and TPACK is used mainly for measurement purposes rather than interventions and is virtually non-existent for APE (Harris et al. 2010; Hofer and Harris 2012). National agencies who train teachers could start off with building resources and practical experiences to build up technological content knowledge. This is especially important given the accelerated digitalisation of the workplace (Kluzer, Centeno, and O'Keeffe 2020).

The updated European standards have been contextualised to the environment of special education physical education teachers and follow up is needed in the expansion, delivery, and implementation. In Europe, training provisions of pre-service APE may be minor additions to existing physical education courses, or as part of a major/specialisation in adapted physical activity often depending on the different types of education systems in each count (Heck et al. 2020). Other opportunities exist in the pan-European university diploma in adapted physical activity (EUDAPA) that require mobility of students to come together from around Europe and concentrate intensely for a semester in alignment with the standards (Mauerberg-deCastro et al. 2018). In addition to APE, EUSAPA covers other dimensions, such as recreation and sport, as well as rehabilitation (Klavina and Kudlacek

2012). A similar exercise to update all dimensions of EUSAPA with the 21st Century skills would make the revision complete.

One relevant aspect not covered in TPACK is the use of assistive technologies to support daily school life in special education schools (Jenny, Krause, and Armstrong 2020). Various legal systems concerning the inclusion of students with SEN in physical education across Europe is a challenge towards a universal standard (Mauerberg-deCastro et al. 2018). Moreover, this lack of knowledge may reduce self-efficacy when working with specific groups (Block et al. 2013) and can make the successful transition to homeschooling harder. Neece, McIntyre, and Fenning (2020) reported families' with young children with intellectual and developmental disabilities encountered their biggest challenge from being at home caring for their children with the loss of many essential services and seeing their child have restrictions to social engagement opportunities. As such, further studies on the relationships between teachers and parents in APE is needed.

This study has some limitations to consider. The evidence was based on 125 teachers in different parts of Europe which was short of the planned recruitment of 400 teachers. This was partly due to the timing of the data collection as some countries had started summer vacations, some were having to deal with examinations and teachers were overwhelming busy with other work tasks during the data collection period. A further limitation was the different approaches to remote teaching during lockdown due to different COVID-19 restrictions. The experts who worked on the consensus could have been drawn from wider expertise with the perspectives beyond the higher education sector. As a specific field of teacher education that crosses over physical education and special education, it was difficult to find more willing volunteers to take part within the short time frame for this publication. EUSAPA has also two more contexts; rehabilitation, as well as sports and recreation, which were not included in this study. Nonetheless, the focus on the APE is a crucial step forward given the circumstances that arose from the COVID-19 restrictions.

Conclusions

The EUSAPA education context has been revised to reflect the 21st Century technological skills that were emphasised as a result of school closures and COVID-19 restrictions. APE teachers used a variety of communication tools with students and colleagues during lockdown. The updates for the educational standards were developed through a consensus approach that used current evidence, expert opinions, and considerations of environmental settings. New EUSAPA functions were identified, as well as technological indicators, that can be used to develop and meet the training needs of APE teachers. There is a need to provide technological content knowledge among special education physical education teachers and implementation of training would need to be adaptive and consider level of teaching experience of attendees.

Disclosure statement

No potential conflict of interest was reported by the authors.

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