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A Framework of the Factors Affecting the Adoption of ICT for Physical Education

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Abstract**—**Physical education (PE) is still neglected in schools despite its academic, social, psychological, and health benefits. Based on the assumption that Information and Communication Technologies (ICTs) can contribute to the development of PE in schools, this study aims to design a model of the factors affecting the adoption of ICTs for PE in schools. The proposed model is based on a sound theoretical framework. It was designed following a literature review of technology adoption theories and of ICT adoption factors for physical education. The technology adoption model that fitted to the best all ICT adoption factors was then chosen as the basis for the proposed model. It was found that the Unified Theory of Acceptance and Use of Technology (UTAUT) is the most adequate theoretical framework for the modeling of ICT adoption factors for physical education.

Keywords**—**Adoption factors, basic education, physical education, technology adoption theories.

I. Introduction

THE importance of sports in primary and secondary education is now well recognized worldwide. According to a study by [1], physical education is highly recommended for all ages because of the documented health benefits of physical activities. A similar conclusion is reached by [2] according to whom "physical education helps children:

- To develop respect for the body—their own and others.
- Contributes toward the integrated development of mind and body.
- Develops an understanding of the role of aerobic and anaerobic physical activity in health.
- Positively enhances self-confidence and self-esteem.
- Enhances social and cognitive development and academic achievement.
- Provides opportunities to meet and communicate with other people.
- To take different social roles.
- To learn particular social skills (such as tolerance and respect for others).
- To adjust to team/collective objectives (such as cooperation and cohesion).
- Provides experience of emotions that are not available in the rest of life".

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II. Problem Statement

Although the benefits of physical education are generally recognized as stated above, it is regrettable that physical education is still neglected in schools; as already pointed out in 1956 by the following extract from [3]."In certain countries, the place assigned to sports in schools remains theoretical rather than practical. Head teachers in their majority are more concerned with the pupils' progress in the intellectual subjects than with the practice of sport. Governmental schools in the main look to local authorities to provide playing fields, courts and swimming pools. The majority of non-governmental schools, however, consider that it is the function of the school to provide its own facilities, including swimming pools, and that each school should have such facilities for its exclusive use. At the primary level, physical education and sport are characterized by the fact that they are everywhere compulsory but are taught by non-specialist teachers, that only a limited number of hours is devoted to them (usually 2 hours a week) and that they suffer from lack of facilities and equipment".

More recent papers such as [4] and [5] are in agreement with [3] on the neglected status of sports in schools. According to [4], physical education classes are being replaced with other classes in an effort to increase students' academic performance. Similarly, results from [5] indicate that many teachers have negative attitudes towards PE because of their own student experiences of PE and sport in schools. This raises the concern that these teachers may rely on these negative experiences to guide their teaching and decision-making towards PE.

III. Aim and Objectives

Turning our attention to the bigger context of education, like most human activities, education is being affected by the progress made by information and communication technologies. In fact, ICTs offer several benefits to teaching and learning, as summarized by the following extract from [6].

- "Increasing productivity related to speed and efficiency of routine processes, and increasing lesson pace.
- Providing 'immediate feedback' and encouraging 'self-correction', and supporting problem-solving strategies through repeated 'trial and improvement' of conjectured solutions.

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- Providing 'novelty' and 'variety', creating 'interest' and 'excitement', and 'adding more fun' using 'a different teaching and learning style.
- Fostering pupil independence and peer support: offering pupils more 'responsibility for doing the learning', 'autonomy', 'ownership', and opportunities to share their expertise with peers or provide mutual support.
- Increasing pupils' persistence, confidence, satisfaction, and sense of pride—through making revision easy, immediate, and invisible, reducing perceived criticism, and improving presentation.
- Broadening referencing and increasing currency of activity: opening up access to 'up-to-date and broad-ranging' and 'more modern, novel' information resources.
- Increases salience of underlying concepts and features of situations; helps students to formulate new ideas or 'access a higher learning point'. Similarly, pupils' use of computers for writing can 'free up their thinking'".

Having in mind this impact of ICT on education in general, it seems interesting to investigate how ICT can contribute to the development of physical education in schools, provided that ICT becomes massively adopted for physical education. What are the factors that affect the adoption of ICT for physical education?

The aim of this study is to design a model of the factors affecting ICT adoption for physical education. The choice of physical education as the main theme of this research can be justified by the above described findings that physical education is neglected in schools despite its well known benefits. The ICT adoption factors model for physical education to be proposed by this research is expected to be based on a sound technology adoption theoretical framework. Therefore the two main objectives of this research are to investigate existing technology adoption theoretical frameworks and to identify ICT adoption factors for physical education.

IV. Literature Review

Readers will found out in the next section of this paper that this study is designed as a two-stage' literature review.

V. Research Design

This research is designed in the form of a literature review. A first literature review will be conducted to identify technology adoption theories in general. A second literature review will be conducted to identify factors affecting ICT adoption for physical education. The authors will then attempt to fit these factors into each technology adoption theoretical framework, and then choose the best framework using factors fitness as comparison criteria.

VI. Results

This section presents the results of this research in terms of the identification of existing technology adoption theories, and of ICT adoption factors for physical education. The section ends with the presentation of the fitness of the above mentioned factors in the identified theoretical frameworks, as a step towards the selection of the most appropriate theoretical framework.

A. Technology Adoption Theories

The results of this study are based on the literature review of existing technology adoption theoretical frameworks, namely: the Theory of Planned Behavior (TPB), the Technology Acceptance Model (TAM), the Unified Theory of Acceptance and Use of Technology (UTAUT) model, and the Technology-Organization-Environment model (TOE).

1. The Theory of Planned Behavior

The Theory of Planned Behavior or TPB [7] postulates three conceptually independent variables determinants of intention. The first variable is the *attitude toward the behavior* (AB) and it "refers to the degree to which a person has a favorable or unfavorable evaluation or appraisal of the behavior in question" [7]. The second variable is a social factor termed *subjective norm (*SN); it" refers to the perceived social pressure to perform or not to perform a behavior" [7]. The third antecedent of intention is the degree of *perceived behavioral control* (PBH) which "refers to the perceived ease or difficulty of performing a behavior and it is assumed to reflect past experience as well as anticipated impediments and obstacles" [7].

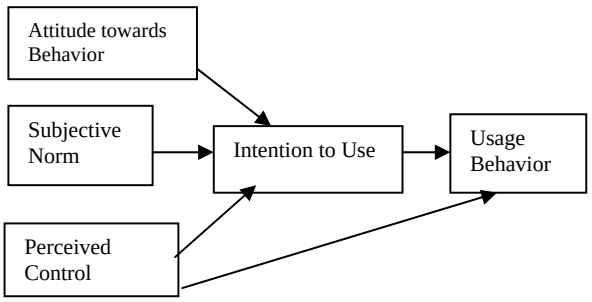


Fig. 1 The Theory of Planned Behavior (TPB) [7]

2. The Technology Acceptance Model

The Technology Acceptance Model or TAM states that user acceptance of technology is affected by perceived usefulness and perceived ease-of-use [8]. Perceived usefulness is defined as "the degree to which a person believes that using a particular system would enhance his or her job performance" and perceived ease-of-use is defined as "the degree to which a person believes that using a particular system would be free of effort" [8].

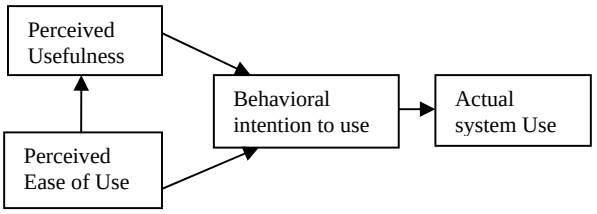


Fig. 2 The Technology Acceptance Model (TAM) [8]

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3. The Unified Theory of Acceptance and Use of Technology

The Unified Theory of Acceptance and Use of Technology or UTAUT [9] postulates that four constructs play a significant role as direct determinants of user acceptance and of usage behavior: performance expectancy, effort expectancy, social influence, and facilitating conditions. Performance expectancy is defined as "the degree to which an individual believes that using the system will help him or her to attain gains in job performance" [9]. Effort expectancy is defined as "the degree of ease associated with the use of the system" [9]. Social influence is defined as "the degree to which an individual perceives that [other important people] believe he or she should use the new system" [9]. Facilitation conditions are defined as " the degree to which an individual believes that an organizational and technical infrastructure exists to support use of the system" [9].

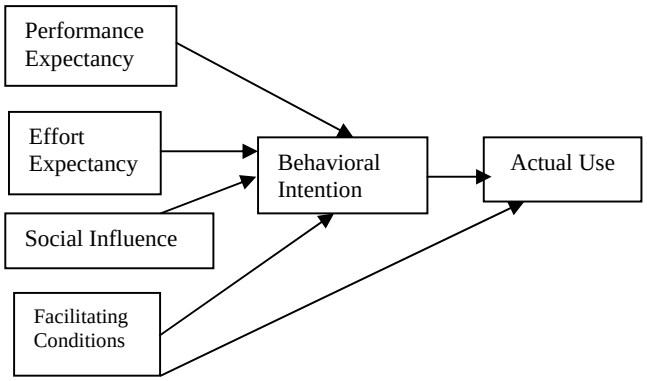


Fig. 3 The Unified Theory of Acceptance and Use of Technology (UTAUT) [9]

4. The Technology-Organization-Environment

According to [10] cited by [11], the Technology-Organization-Environment or TOE framework, developed in 1990 identifies three aspects that influence the process by which an enterprise adopts and implements technological innovations. These three aspects are: the technological context of the enterprise, its organizational context, and its environmental context. The *Technological context* describes "both the internal and external technologies relevant to the firm, this includes current practices and equipment internal to the firm, as well as the set of available technologies external to the firm" ([10] cited by [11]). The *Organizational context* refers to "descriptive measures about the organization such as scope, size, and managerial structure ([10] cited by [11]). The *Environmental context* refers to "the arena in which a firm conducts its business—its industry, competitors, and dealings with the government" ([10] cited by [11]).

B. ICT Adoption Factors for Physical Education

The following factors were found during the review of existing literature on the adoption of ICT for physical education: Training for teachers to use ICT, support from stakeholders, availability of regular power supply, availability of resources, staff enthusiasm, technical support, gender, time within lessons, teachers' confidence, and organizational change.

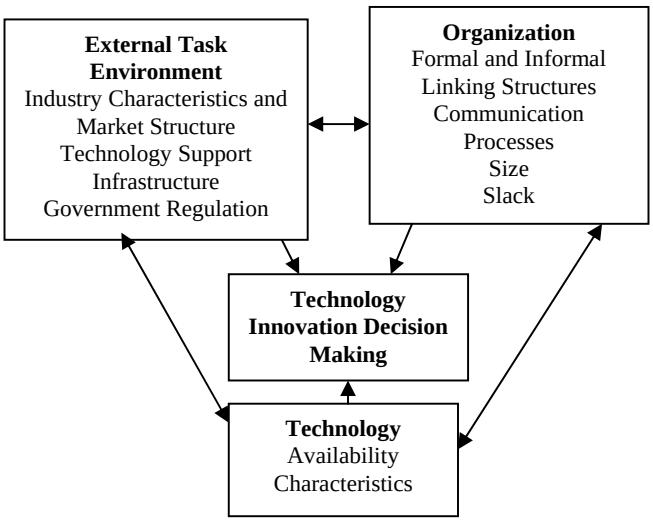


Fig. 4 The Technology-Organization-Environments (TOE) (By [10] cited by [11])

TABLE I
ICT ADOPTION FACTORS FOR PHYSICAL EDUCATION FROM LITERATURE

Factors	References
B1. Training for teachers to use ICT	[12]
B2. Support from stakeholders	[5], [14]
B3. Availability of regular power supply	[13], [14]
B4. Availability of Resources	[15, 16], [4], [6], [13]
B5. Staff enthusiasm	[5], [16]
B6. Technical support	[5], [16], [17]
B7. Gender	[18],
B8. Time within lessons	[5], [17]
B9. Teachers Confidence	[5]
B10. Organizational change	[15]

1. Training for Teachers to Use ICT

According to [12], the adoption of ICT for physical education depends on the quality of the ICT training received by PE teachers during their pre-service studies. Reference [12] further indicates that taking full advantage of the potential of ICT in PE presupposes that PE teachers are trained to creatively integrate ICT into their courses.

2. Support from Stakeholders

According to [5] and [14]the adoption of ICT for physical education depends on the level of collaboration between schools stakeholders such as senior management, ICT coordinators, and PE departments.

3. Availability of Regular Power Supply

According to [13] and [14] the adoption of ICT for physical education is affected by the quality of the power supply in schools.

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4. Availability of Resources

According to [15], [16], [4], [6], and [13], the adoption of ICT for physical education is affected by the lack of financial assistance for the purchase of computing equipment and software. In many schools, PE is still not seen as a priority area, and the allocation of resources and equipment to PE departments is still only just being recognized and established. There is a need for increasing the availability of resources for physical education to expand technological understandings.

5. Staff Enthusiasm

According to [5] and [16], the adoption of ICT for physical education depends on the PE teachers level of enthusiasm for making use of ICT in teaching and learning PE.

6. Technical Support

According to [5] and [16], the adoption of ICT for physical education is affected by the availability of technical support Reference [17] also indicated that trained technicians must be employed within PE departments.

7. Gender

According to [18], the adoption of ICT for physical education depends on the gender of the PE teacher. Existing research shows that, compared to female PE teachers, male PE teachers have better ICT skills, use ICTs more in their leisure time, have more positive attitudes than females, and take on more independent challenges for learning ICTs.

8. Time within Lessons

According to [5] and [17], the adoption of ICT for physical education is affected by insufficient time between lessons. Reference [5] also mentions the 'problem' of time when ICT was 'added to' existing practice in the existing structures, timetables and syllabus.

9. Teachers Confidence

According to [5], the adoption of ICT for physical education is affected by PE teachers lack of confidence.

10. Organizational Change

According to [15], the adoption of ICT for physical education is affected by the organizational change. PE teachers take decisions that are intended to confirm their beliefs about the educational effectiveness of innovations, and in fact practicable innovations and organizational changes constantly occur in schools.

C. Matching factors with theories

This section describes how the above identified PE ICT adoption factors were fitted in the technology adoption theoretical frameworks.

1. The Theory of Planned Behavior

Fig. 5 shows that it is possible to model ICT adoption factors for physical education using the Theory of Planned Behavior (TPB). However, the classification of the following ICT adoption factors for physical education is questionable: training for teachers to use ICT, support from stakeholders, technical support, gender, and time within lessons.

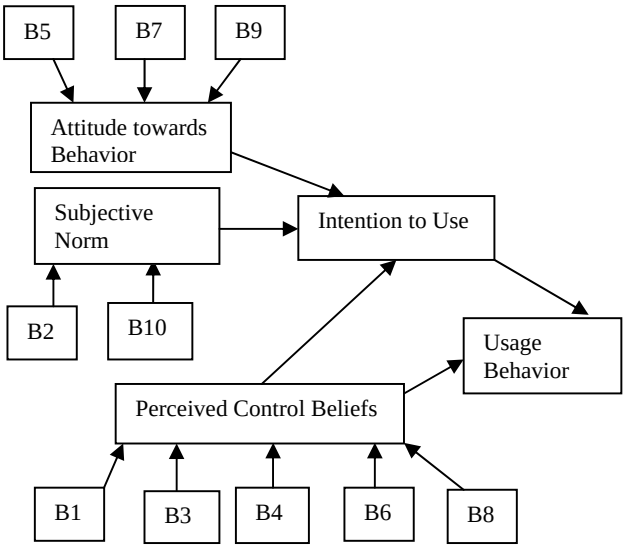


Fig. 5 TPB based ICT adoption factors for PE

2. The Technology Acceptance Model

Fig. 6 shows that it is possible to model ICT adoption factors for physical education using the Technology Acceptance Model (TAM) technology adoption theory. However, the classification of the following ICT adoption factors for physical education is questionable: Training for teachers to use ICT, Support from stakeholders, availability of regular power supply, availability of resources, and organizational change.

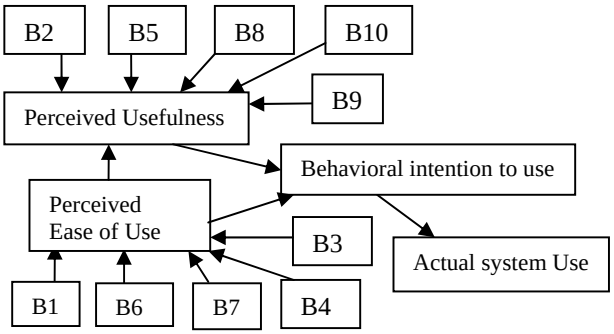


Fig. 6 TAM based ICT adoption factors for PE

3. The Unified Theory of Acceptance and Use of Technology

Fig. 7 shows that it is possible to model ICT adoption factors for physical education using the Unified Theory of Acceptance and Use of Technology (UTAUT) technology adoption theory. However, the classification of the following ICT adoption factors for physical education is questionable: training for teachers to use ICT, staff enthusiasm, technical support, and time within lessons.

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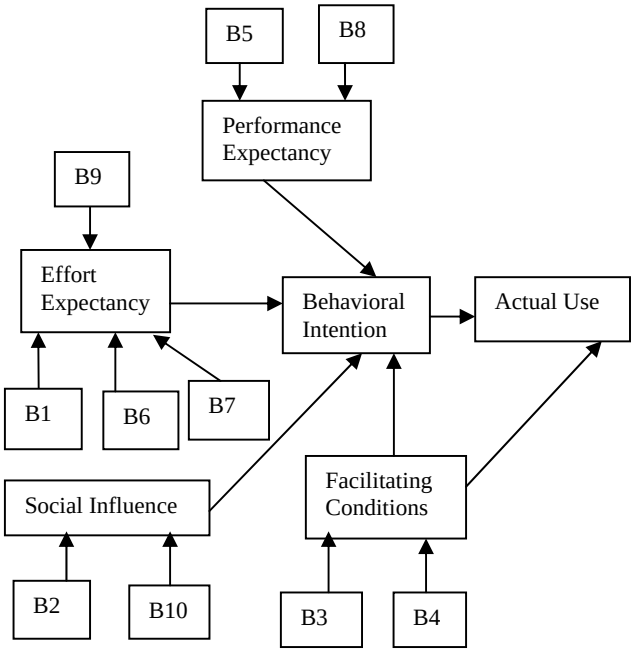


Fig. 7 UTAUT based ICT adoption factors for PE

4. The Technology-Organization-Environment

Fig. 8 shows that it is possible to model ICT adoption factors for physical education using the Technology-Organization-Environment (TOE) technology adoption theory. However, the classification of the following ICT adoption factors for physical education is questionable: training for teachers to use ICT, gender, time within lessons, organizational change, technical support, and teachers' confidence.

D. Modelling ICT Adoption Factors for Physical Education

When matching ICT adoption factors for physical education with existing technology adoption theories, one reaches the conclusion that ICT adoption factors for physical education can be adequately modeled using the Unified Theory of Acceptance and Use of Technology (UTAUT) technology adoption theory.

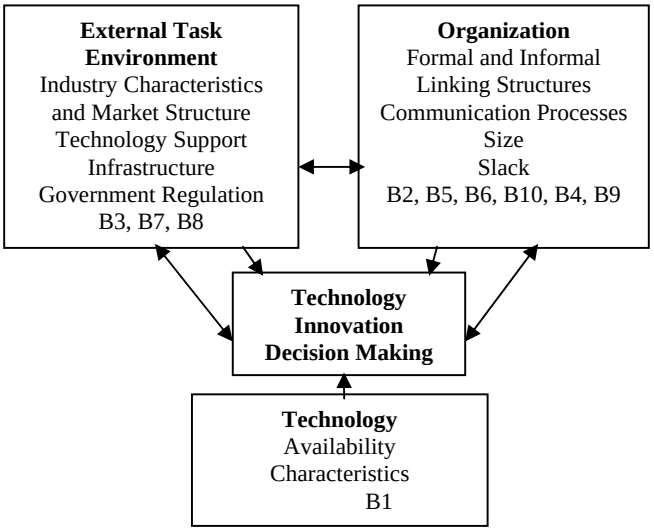


Fig. 8 TOE based ICT adoption factors for PE

E. Discussion and Conclusion

In this paper, a review of existing technology adoption theories is conducted followed by a review of ICT adoption factors for physical education. These ICT adoption factors for physical education are then matched with the technology adoption theories in order to identify the best technology adoption theories for ICT adoption in physical education. According to the results of this paper, the UTAUT theory is the most suitable framework for the modeling of ICT adoption factors for physical education. The main contribution of this paper resides in the fact that it provides evidence on the suitability of existing technology adoption theories for the modeling of ICT adoption factors for physical education, instead of just choosing one theory over another as usually done in other studies. Future research will attempt to empirically validate the theoretical models proposed by this paper.

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