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USING DSO AWARENESS FOR THE ANALYSIS OF COMPUTING STUDENTS' PERCEPTION ON THE CURRENCY OF THEIR CURRICULUM

Oluwakemi D. Adegbehingbe, Durban University of Technology, Durban, South Africa;
Seraphin D. Eyono Obono, Durban University of Technology, Durban, South Africa

Abstract :The need for economic operators to improve their competitiveness can be considered as one of the factors that motivates technological innovations. It is therefore important for education systems to stay in line with these technological changes by updating their curriculum as often as possible. Digital Switch Over (DSO) is one example of such technological innovations. The purpose of this paper is to analyse the perceptions of students on their awareness of Digital Switch Over, using a survey of a sample of university students enrolled in computer related courses in the KwaZulu-Natal province of South Africa. The results of this survey indicate that there is a correlation between students' awareness of general ICT trends, their perceptions on the currency of their curriculum, and their perceived awareness of Digital Switch Over.

Introduction

Effective curriculum design is necessary in order to prepare and equip students for workplaces' and life challenges [1]. Some of these challenges are technological in nature. For instance, over the past years, technologies used by computers and phones have evolved rapidly. This poses a great challenge for students in the field of computing because they are expected to adapt their knowledge, skills, and attitudes according to the requirements of these new technologies. For example, a technology change known as Digital Switch Over (DSO) is currently occurring worldwide and it affects the way television signals are transmitted. DSO consists of the conversion of television broadcasting signals and materials from analog to digital [2]. This is expected to benefit the global economy by allowing new available frequency spectrums to be utilized for a wider range of services. Even though it is important for the general public to be aware of the DSO hardware and software requirements, this is even more relevant for students in the field of computing because they are supposed to be the ones that are in charge of maintaining and improving these technologies. The aim of this paper is to analyse the perceptions of computing students on the currency of their curriculum based on the analysis of their awareness of general ICT trends, and of DSO.

Theoretical Framework

There are few theoretical frameworks on curriculum research in general and on the evaluation for curriculum currency in particular. Two research articles were found in the existing literature on the possible building blocks of a theoretical framework for curriculum evaluation. The first research article was written in the sixties and it basically provides a literature review of the existing research on curriculum studies in the sixties [3]. On the other hand, the second article proposes a theoretical framework for "Research-based Curricula" [4]

The goal of curriculum evaluation is the answering of the important question on the selection, adoption, support and worth of educational materials and activities [3, 5]. Curriculum evaluators should seek out and record the opinions of relevant persons involved in the curriculum under study. These opinions can be useful when gathered objectively independently of the solicitor's opinions for the purpose of curriculum evaluation [3]. On the other hand, evaluation of curriculum must be done to assess the impact and the fidelity of curriculum implementation for various education stakeholders such as "children, teachers, program administrators, and parents" [4]. A Curriculum Research Framework (CRF) consisting of ten phases covering both curriculum design research and curriculum evaluation research was proposed by Clements [4]. It is worth noting that it is in the tenth phase of the CRF that Clements addresses the assessment of the impact of the curriculum implementation on "participating children, teachers, program administrators, and parents". This phase of the CRF can be summarised by equating curriculum evaluation to the analysis of three categories of research variables: contextual variables (e.g. settings, such as urban or rural; type of program; class size, teacher characteristics; student or family characteristics), implementation variables (e.g. engagement in professional development opportunities; fidelity of implementation; leadership capabilities, as well as support and availability of resources, funds, and time, peer relations at the school, and learning outcome variables.

CRF was chosen as the theoretical framework of the current research on the analysis of computing students' perceptions on the currency of their curriculum. The CRF contextual variables are represented in this research by a research variable on students' demographics. CRF implementation variables are represented in this research by variables on students' exposure to career guidance opportunities and on students' perceptions on the currency of their curriculum. Finally, CRF learning outcome variables are represented by

a research variable on the perceived currency of the curriculum and by the dependent variable on students' awareness of Digital Switch Over (DSO). All these research variables will be described further later in the research design section of this paper. The next section of this paper is dedicated to the review of existing literature on the improvement of curriculum currency in computing related disciplines.

Literature Review

This section focuses on existing literature on how to improve computing curriculums to make it relevant for the workplace and to be able to face new challenges in the different computing disciplines, including Computer Science, Software Engineering, Information Technology, and Computer Engineering.

Computer Science

Mobile devices and applications should be a core topic in the undergraduate computer science curriculum [6]. This finding was the result of experiments conducted at the University of Guelph-Humber in Canada where mobile devices and applications were integrated in lower and upper division programming courses. On the other hand, it was found that stronger computer security education will make the computer science curriculum more effective in view of current increasing malicious activities [7].

Software Engineering

More attention should be given to software design and architecture, user interface issues, project management, and written and oral presentations [8]. This result was found from the survey of 214 respondents working in the field of Software Engineering. Seventy five topics were presented to the respondents of this survey for them to indicate which topics were most relevant to them in their careers.

Information Technology

Computer networks and system analysis and design are essential for the work relevance of the information technology curriculum [9]. This was found from the analysis of online ICT employment opportunities that showed an increasing trend in vacancies related to computer networks and to system analysis and design. On the other hand, a case study based on a market orientation strategy found that students' views should catalyse changes in the IT curriculum for the purpose of maintaining curriculum currency [10].

Computer Engineering

According to a case study of the implementation of a computational science and engineering curriculum in a Denmark University, for computational science and engineering students to be strongly competitive in the labour market, their curriculum must be based on a combination of mathematical modelling, software engineering, and user centred design, to help them develop practical skills and broad knowledge for modern computer technologies [11].

Research Design

The above brief literature review indicates that existing studies on the improvement of curriculum currency in the computing field are based on surveys, experiments, and case studies. The current research is no exception to this trend as it is designed as a survey.

This is a questionnaire-based survey on students' perceptions on the currency of their curriculum with regard to general ICT trends as well as on their awareness of Digital Switch Over (DSO). These students were selected from all the four universities of the KwaZulu-Natal (KZN) province of South Africa, from the departments of Information Technology (for two universities), Computer Science (two universities), and Computer Engineering (two universities). Only third year students were selected in this survey mainly because of their supposed familiarity with their curriculum. These students were also selected because DSO involves both computer hardware and computer software potentially relevant to the above listed fields of computing.

The distribution of the questionnaire was done during lecture hours for a third year class with the permission of the lecturer in charge. Twenty students were supposed to be randomly selected from each of the six above mentioned classes. However this was not always possible especially for small classes. The final sample of the survey therefore consisted of 116 students.

Research Variables

It is worth recalling that CRF was described earlier in this paper as the theoretical framework of this research with contextual variables represented by a research variable on students' demographics, with implementation variables represented by research variables on students exposure to career guidance opportunities and on students' perceptions on the currency of their curriculum, and with learning outcome variables represented by a research variable on the perceived currency of the curriculum, and the dependent variable on students' awareness of Digital Switch Over (DSO).
The above research variables were translated by four 5-point Likert scale sections on a questionnaire and one non-Likert scale demographic section.

Students' demographics consisted of 10 questionnaire items namely gender, ethnicity, high school location, programme of study, high school computing option, university's name, mode of study, age group, and year of study.

Students' exposure to career guidance was examined by items requesting students to indicate whether they had received career guidance from their lecturers, their teachers, their parents, their university counseling center, etc.

ISSN:2319-7900

Students' awareness of general ICT trends was measured by questionnaire's items such as their awareness of Cloud computing, Grid computing, Biometrics, Artificial Intelligence, etc.

Students' perceived currency of their curriculum was measured by questionnaire's items requesting students to indicate whether they thought that their curriculum was regularly renewed, that their learning materials were regularly updated, etc.

Finally, students' awareness of DSO was measured by items such as their awareness of the DSO deadline for the world, their awareness of hardware and software requirements after DSO, etc.

Research Results

Before presenting the results of these research, it seems important to first describe how was its analysed.

Data Analysis

Data collected from the questionnaire was quantitatively analysed using the SPSS software package. This data was first tested for reliability and validity before its descriptive analysis and its inferential analysis. This descriptive analysis included mean and frequency analysis. Inferential statistics included ANOVA, ANCOVA, and Pearson's correlations.

Data Reliability and Validity

Table 1 shows that the data collected by this questionnaire based survey is reliable (all Likert-scale based research variables have a Cronbach's alpha value > 0.7). The Questionnaire items column shows that the research variable items split into exactly four components, and each of these four components matches exactly its own research variable. This shows that questionnaire items passed validity test.

TABLE 1: Reliability and Validity Results of Variables

Variables	No of questionnaire Items	Cronbach's Alpha coefficient (α)
Exposure to Career guidance Opportunities	10	0.755
Awareness of general ICT trends	10	0.836
Perceived currency of the curriculum	10	0.869
Digital Switch Over (DSO) awareness	10	0.948

Descriptive Statistics

This section presents the descriptive statistics of the demographics and the Likert scale variables which include students' exposure to career guidance, their awareness of general ICT trends, their perception on the currency of their curriculum and their DSO awareness.

Demographics

The descriptive statistics calculated on the demographic data of this research show that the typical student surveyed by this research is: an African (80.2%), aged between 20 to 22 (66.4%), male (72.4%), resides in the urban area (54.3%), did core mathematics in high school (98.3%), and did End user computing in High School (52.5%).

Likert Scale Variables

Research results presented in Table 2 indicate the moderate nature of the perceptions of the students on their exposure to career guidance (mean of 7.8190 out of 15), and their awareness of DSO (13.5948 out of 24).

It also indicates the above average nature of their level of awareness of general ICT trends (mean of 20.2241 out of 30), on the perceived currency of their curriculum (mean of 35.2328 out of 46).

Table 2 Descriptive statistics for Likert-scale based research variables

Var*	Range	Min	Max	Mean	Variance
B	12.00	3.00	15.00	7.8190	6.028
C	24.00	6.00	30.00	20.2241	18.401
D	33.00	13.00	46.00	35.2328	37.398
E	19.00	5.00	24.00	13.5940	22.121

*Var: Research Variables for Table 2
B: Career Guidance Exposure
C: Awareness of General ICT Trends

D: Perceived Curriculum Currency
E: Awareness of Digital Switch Over

Inferential Statistics

Statistical tests were performed in this study to assess whether the awareness of Digital Switch Over by the students (dependent variable) in the field of computing was affected by any of the following independent research variables: students' career guidance exposure, students perceived currency of their curriculum and students' awareness level of ICT technologies. The results of these tests are presented in Table 3, Table 4 and Table 5.

Table 3 indicates that only high school location among the demographic variables significantly ($p < 0.05$) affect students' awareness of DSO

TABLE 3 ANOVA Results

Questionnaire Items	F test(sig)	Levene's Test (sig.)
Age Group	0.537	0.224
Gender	0.929	0.926
Ethnicity	0.136	0.333
University	0.072	0.218
Programme of Study	0.317	0.656
Mode of Study	0.960	0.376
High School Maths Option	0.858	0.103
High School Location	0.005	0.015
High School Computing Course	0.050	0.287

The analysis of Table 4 with the purpose of assessing the correlation between the dependent variable against each of the three independent variables shows that

Students' awareness of DSO is significantly (0.01 level) affected by students' perceived awareness of general ICT trends ($p = 0.000$), by their perceived currency of their curriculum ($p = 0.000$), and by their Career Guidance Exposure ($p = 0.002$).

TABLE 4 Pearson Correlations

		B	C	D	E
Career Guidance Exposure	Pearson Correlation	1			
	Sig. (2-tailed)				
	N	116			
Gen ICT Trend Awareness	Pearson Correlation	.238**	1		
	Sig. (2-tailed)	.010			
	N	116	116		
Perceived Curriculum Currency	Pearson Correlation	.370**	.309**	1	
	Sig. (2-tailed)	.000	.001		
	N	116	116	116	
DSO Awareness	Pearson Correlation	.282**	.337	.348	1
	Sig. (2-tailed)	.002	.000	.000	
	N	116	116	116	116
** correlation is significant at 0.01 level (2 tailed)					

ANCOVA results from table 5 shows that when high school location is combined with the three independent variables: students' career guidance exposure, students perceived currency of their curriculum and students' awareness level of ICT technologies, it can be observed that high school location, students' level of awareness of general ICT trends and students' perceived currency of their curriculum influence students' awareness of DSO.

Discussion

Although there are many studies in the existing literature on how to improve curriculum currency in the field of computing, none of these studies focuses on Digital Switch Over awareness as a research variable to measure computing curriculum currency. One can therefore argue that the choice of DSO awareness as a measure of computing curriculum currency is the first novelty of this paper. The results of this paper are based on the analysis of survey data just like many other papers from the existing literature on how to improve the currency of the computing curriculum. However, another novelty of this paper is its anchoring of its research variables on a sound theoretical framework, the Curriculum Research Framework (CRF). The use of a theoretical framework becomes crucial for the development of a consistent body of curriculum research where studies can be built from one another. It is also important to note that the results of this study can further be explored by future research on how to translate these findings into curriculum changes recommendations in the field of computing as it was done in the publications presented in the literature review section of this paper.

TABLE 5 ANCOVA Results

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Tests of Between Subject Effect					
Dependent Variable: Digital Switch Over Awareness					
Source	Type III Sum of Squares	df	Mean of Square	F	Sig
Corrected Model	626.321[a]	4	156.580	9.063	.000
Intercept	2.346	1	2.346	.136	.713
B	39.727	1	39.727	2.300	.132
C	125.217	1	125.217	7.248	.008
D	83.566	1	83.566	4.837	.030
High School Location	126.122	1	126.122	7.300	.008
Error		111	1917.635		
Total		116	23983.00		
Corrected Total	2543.957	115			
a. R Squared = .246 (Adjusted R Square .219)					

Conclusion

This paper shows that students' high school location, their awareness level of general ICT trends, and their perceived currency of their curriculum affect their awareness of new technologies such as DSO. This result can assist in making useful recommendations towards improving and renewing the computing curriculum. The need to ensure the currency of the computing curriculum is further emphasised by the results of this research.

Ideas for future research from this paper include: further investigations of ways of improving the currency of computing curriculum, investigation on measuring the currency of curriculums, investigating what influences lecturers' awareness of new technologies, development of new frameworks for analysing the currency and improvement of computing curriculums.

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