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Integration of Technology Education in Technical and Vocational Education Curricula; A Solution to Paucity of Skilled Workforce

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This study aims to explore the integration of technology education in technical and vocational education (TVE) curricula. Both qualitative and quantitative techniques were used in this study. Thus, the data was collected by semi-structured interviews and questionnaires from 179 teachers and administrators of TVTC in Saudi Arabia. The manual coding method was used to analyse qualitative data. The results revealed that the importance and implementation strategies of technology integration in technical and vocational education are completely known to stakeholders. In addition, the study found significant and strong relationships between mission, vision, resource availability, teacher preparation and teacher's technology integration. The study merely focused on the implementation of technology education in Saudi Arabia. Therefore, in future this study can be replicated in context for other countries. Furthermore, the same framework can be used for comparing technology integration in technical and vocational education curricula of developed and developing countries.

Key words: *Technology Education, Integration of Technology, Curriculum Development.*

Introduction

Knowledge is considered as competitive advantage in this era of technological revolution. The job market needs in Saudi Arabia are entirely different from traditional vocational education (Achoui, 2009), and technology can play a bridging role between this gap (Den Hertog & Bilderbeek, 2000). Therefore, in order to enable citizens to compete in rapid globalisation, the change in education is required at every level. Technology can support a culture of lifelong learning through technical and vocational education and training (TVET) (Almutairi, 2015). The National Transformation Program 2020 described the Saudi Vision 2030 as a roadmap for development. It outlines the Kingdom's vision, objectives and directions to accomplish its goals. The biggest goal of this program is to improve the education quality by refining the national curriculum, training teachers, and creating innovation in advanced technologies (Alghamdi, 2017). Integrating technological education will fill the gap between the outputs of education and the requirements of job markets by creating a modern curriculum. Curriculum integration is supported by socio-cultural factors, unlike traditional curricula that are not linked to students' everyday life, and unable to address their daily needs or problems (EL-Deghaidy et al., 2017). Every developed and developing country is recognising the importance of implementing technological education in today's educational curriculum. The literature in this domain is still at an embryonic stage and no comprehensive study in this area has been conducted within the context of Saudi Arabia. Therefore, this study explored the extent of integration of technology education in the technical and vocational education (TVE) of Saudi Arabia and gained an understanding of ways in which technological education can be integrated into Saudi TVE.

Literature Review

Rapidly changing technological advances have reshaped the 21st-century workforce, the educational needs of the labour force, and the institutions which provide career and technical education (CTE) across the globe, by making technological literacy a key success factor in the 21st-century workforce. The technology has changed the types of skills and knowledge used in the workplace (Washbon, 2012). More specifically, Foster et al., (2011) found that students need a combination of technical skills, academic skills, and employability skills to be successful in the 21st century. There are different views and definitions of technology education but researchers agree on some common features, including objectives, content and teaching methods (Benson and Lunt, 2011). The objective of technology education is to impart factual competence, method competence and competence for evaluation and assessment among learners. While factual competence is achieved by implementing exemplary structural and functional knowledge about technology and processes in learners, method competence involves usage of technology-specific ways of thinking and working, developing the learner's creativity and their ability to cooperate and effectively communicate through technical actions and operations. Students are taught to assess and critically question the manner in which technology is developed, produced and used under economic, ecological and social constraints (Hopken, 2008). In order to teach technology effectively, a teacher must have thorough understanding of technology (Forret et al., 2011; Vries, 2012). According to Vries (2012), the idea of a STEM (Science, Technology, Engineering, and Mathematics) oriented curriculum is to teach students of all four disciplines. However, a keen look at policy makers' and researchers' plans for comprehensive STEM education indicates that, in most cases, technology and engineering are not included. This is in spite of the fact that technology has become a compulsory subject in many countries and can be found in the curricula of all regions (Foster et al., 2011).

In Saudi schools, instead of focusing on technology education and considering it a separate subject in the curriculum, the technology is taught as a subtopic in science curriculum. Many teachers consider these topics as scientific subjects, and this understanding highlights the absence of technology education as a concept and technology as a major subject in the Saudi curriculum, which would help stakeholders to recognise the principles of science and technology (Washbon, 2012). In the Saudi context, the Ministry of Education encourages teachers to implement the "Penta-method" strategy for teaching science and technology in classrooms. Al-Hatriti and Al-Mazroa (2013) explained that this strategy involves integrating learning cycles and concept mapping into one strategy that is implemented through five steps: (1) Preparation—prepare students to be engaged in the discussion; (2) Exploration and investigation—have students implement activities to explore a particular topic by collecting and recording data to be used for the investigation; (3) Explanation and interpretation—have students explain and interpret data about the topic being investigated; (4) Evaluation—have teachers evaluate the outcome of teaching technology education against set objectives (5) Enrichment and expansion—encourage students to read beyond what they have learned to expand their knowledge about the topic, rather than depending on information given by the school.

Technological advancement in industrial sectors and the internationalisation of technology in education has changed everything. In the US, Germany and Japan, attention given to technological education has previously not measured up to its expectation, and this has led to the ignorance of technology and engineering aspects of STEM subjects (De Vries, 2018; Wright et al., 2018). The educational system in Japan and KSA is controlled by the government, while in the United States and Germany, the federal states are independent in educational matters. According to Murata and Stern (1993), the Ministry of Education, in order to meet up with the changes and keep up the trends of the market demand for human resources reviews its standard course of study every ten years. In KSA, education rests on the shoulders of the Ministry of Education and the Technical and Vocational Training Corporation (TVTC), under the supervision of the Supreme Committee for Educational Policy established in 1963. As with Japan, that had 100% of students completing compulsory education, the KSA also has a ten-year plan in the development of education which provides the result of having the gross enrolment rate for girls to be at 98.1 percent in 2007. Nowadays, technology education in the US, Japan, Germany and KSA is one of the major components in the education curriculum.

Technical and Vocational Training Corporation (TVTC) in Saudi Arabia aims to attract more students and provide them with the necessary skills which can help in the sustainable development of the country. However, many KSA educators believe that the lack of clarification of the educational policy and strategies is a hindrance to the introduction of technology in Saudi schools. For instance, Al-Sulaimani (2010) suggested that a lack of clarification in policies and planning often leads to misconceptions and ignorance about Information and Communication Technologies (ICT) tools. Therefore, many educators in Saudi Arabia have called for clear policy planning in terms of ICT implementation in schools. In addition, Almalki and Williams (2012) have stated that there is a pressing need for the Saudi government to develop and implement an effective strategy for ICT in education in order to prepare students for the job market.

The major aim of designing technology curricula for colleges and institutes requires students to completely understand the nature of technology. To achieve this goal, teachers themselves should first understand technology and technological education. It has been indicated that teachers' perceptions of the nature of technology may affect their perceptions of technology education and their ways of teaching (Forret et al., 2013).

Methodology

The research design of this study used a mixed qualitative–quantitative approach. Data were taken from 179 educational academic leaders and teachers involved in Technical and Vocational Training Corporation (TVTC) by using a questionnaire. Semi-structured interviews were conducted to collect primary data from selected samples; in each semi-structured interview, interviewers began with a small set of open-ended questions, but spent considerable time probing participants' responses, encouraging them to provide detail and clarification. The qualitative data collected was analysed manually through open coding, while quantitative data were analysed by using SPSS and SmartPLs.

Results

Table 1 describes the characteristics of the study participants. 80% of respondents were teachers and 20 % were academic leaders. The majority of respondents were aged 31–40 years (47%) and 41–50 years (29%). Most respondents (74%) reported they work at colleges, with the remainder split between institutes and the TVTC headquarters. The range of average working experience was wide, though over a third reported more than 15 years' experience (36.9%). Most of the respondents reported masters as their highest academic qualification (58.1%). As compare to other specialisations, 31% (i.e. majority) of respondents specialised in engineering.

Table 1: Characteristics of respondents

	Frequency	Percent
Job Title/Position		
Teacher	144	80.4
Academic Leader	35	19.6
Gender		
Male	115	65.3
Female	61	34.7
Age		
Less than 30 years	29	16.2
31 - 40 years	84	46.9
41 - 50 years	52	29.1
More than 50 years	14	7.8
Workplace		
Institute	26	14.5
College	133	74.3
Head Quarter TVTC	20	11.2
Experience		
1 to 5 years	53	29.6
6 to 10 years	34	19.0
11 to 15 years	26	14.5
More than 15 years	66	36.9
Academic Qualification		
BA	17	9.5
MA	104	58.1
PhD	58	32.4
Major		
Engineering	56	31.3
Education	22	12.3
Computer	36	20.1
English	20	11.2
Home Economics	14	7.8
Administration	31	17.3

Research Question 1: *What are stakeholders' perceptions about the effective integration of Technology Education in TVTC?*

Results of stakeholders' perceptions regarding the effective integration of technology education are provided in Table 2 *(See Appendix 1)*. These results highlighted that the mean perception of technology integration was positive. Stakeholders agreed that technology education is foremost important for students, trainers, and in the curriculum. However, respondents indicated that they did not feel that implementation of technology in the curriculum was adequate.

Table 2: Stakeholder's perceptions about effective integration of technology in education?

Sr.	Statement	SDA f (%)	DA f (%)	N f (%)	A f (%)	SA f (%)	Mean
1	The technological revolution requires governments to review curricula	0 (0%)	0 (0%)	4 (2.2%)	50 (27.9%)	125 (69.8%)	4.676
2	The technological revolution will require colleges and institutes to develop students' technological literacy	0 (0%)	1 (0.6%)	4 (2.2%)	56 (31.3%)	118 (65.9%)	4.626
3	Including teaching technology in the colleges and institutes curricula will contribute in developing student's capabilities to solve technological problems	0 (0%)	1 (0.6%)	14 (7.8%)	89 (49.7%)	75 (41.9%)	4.330
4	Students attending colleges and institutes need to acquire knowledge that helps them to keep pace with and to understand technological change	0 (0%)	1 (0.6%)	5 (2.8%)	63 (35.2%)	110 (61.5%)	4.575
5	Students need to develop a wide range of knowledge and some basic technological skills	0 (0%)	0 (0%)	6 (3.4%)	68 (38.0%)	105 (58.7%)	4.553
6	Students attending colleges and institutes need to develop an appreciation of the importance of technology for the development of the country	0 (0%)	0 (0%)	9 (5.0%)	54 (30.2%)	116 (64.8%)	4.598
7	Students attending colleges and institutes would benefit from learning of designing technological products	1 (0.6%)	3 (1.7%)	10 (5.6%)	88 (49.2%)	77 (43.0%)	4.324
8	Students attending colleges and institutes need an awareness and understanding of the interaction between technology and society	0 (0%)	0 (0%)	10 (5.6%)	88 (49.2%)	81 (45.3%)	4.397
9	It is important that students attending colleges and institutes be creative and innovative learners	5 (2.8%)	9 (5.0%)	29 (16.2%)	60 (33.5%)	76 (42.5%)	4.078

10	Hands on and practical activity contribute to making learning more fun	0 (0%)	0 (0%)	8 (4.5%)	70 (39.1%)	101 (56.4%)	4.520
11	Without an understanding of technology, students may feel powerless and threatened	1 (0.6%)	3 (1.7%)	13 (7.3%)	88 (49.2%)	74 (41.3%)	4.291
12	Current primary curricula can contribute to prepare students who are creative and innovative	15 (8.4%)	38 (21.8%)	71 (39.7%)	39 (21.2%)	16 (8.9%)	3.017
13	The training curriculum in the institution is designed according to standards for the integration of technology in training	20 (11.2%)	33 (18.4%)	69 (38.5%)	47 (26.3%)	10 (5.6%)	2.966
14	Current developed curricula for colleges and institutes include several technological topics	8 (4.5%)	32 (17.9%)	54 (30.2%)	72 (40.2%)	13 (7.3%)	3.279
15	Current curricula help trainees to use technology when they enter the labour market immediately after graduation	8 (4.5%)	33 (18.4%)	67 (37.4%)	57 (31.8%)	14 (7.8%)	3.201
16	Trainers are familiar with technology that can be used in training	5 (2.8%)	24 (13.4%)	56 (31.3%)	69 (38.5%)	25 (14.0%)	3.475
17	Trainers comprehend the importance of teaching technology in colleges and institutes to produce technical generation	0 (0%)	0 (0%)	4 (2.2%)	79 (44.1%)	96 (53.6%)	4.514
18	Trainers understand that the use of technology tools and concepts helps learners learn	0 (0%)	5 (2.8%)	17 (9.5%)	86 (48.0%)	71 (39.7%)	4.246
19	I teach and help my students to design and produce simple technical products	5 (2.8%)	12 (6.7%)	62 (34.6%)	58 (32.4%)	42 (23.5%)	3.670

Research Question 2: *Are the stakeholders of Saudi technical and vocational education willing to integrate technology education in the Saudi curriculum?*

Table 3 *(See Appendix)* presents the results of stakeholders' willingness to integrate technology education in the Saudi curricula. The findings suggest that indeed, a good number of stakeholders support the integration of technology in education at an above average level.

Table 3: Stakeholders of technical and vocational educations' willingness to integrate technology education in the Saudi curriculum

Sr.	Statement	SDA f (%)	DA f (%)	N f (%)	A f (%)	SA f (%)	Mean
1	I find in myself the ability and the competence to teach technology in colleges and institutes of education	2 (1.1%)	11 (6.1%)	42 (23.5%)	62 (34.6%)	62 (34.6%)	3.955
2	Instructors from different disciplines can teach technology education	10 (5.6%)	43 (24.0%)	52 (29.1%)	57 (31.8%)	17 (9.5%)	3.156
3	Trainers understand that using technology tools and concepts helps learners learn	0 (0%)	5 (2.8%)	29 (16.2%)	99 (55.3%)	46 (25.7%)	4.039
4	Instructors often discuss technology-related topics	0 (0%)	12 (6.7%)	60 (33.5%)	83 (46.4%)	24 (13.4%)	3.665
5	Current trainers can integrate technology components with their training curriculum	1 (0.6%)	14 (7.8%)	54 (30.2%)	82 (45.8%)	28 (15.6%)	3.682
6	Instructors of colleges and institutes can teach the technology course appropriately despite their different specialties	9 (5.0%)	38 (21.2%)	55 (30.7%)	60 (33.5%)	17 (9.5%)	3.212

Research Question 3: *Is there any statistical difference among educational leaders and teachers in the behavioural intention to integrate technology into the curriculum?*

Table 4 (*See Appendix*) provides the statistical results about differences in behavioural intentions to integrate technology in education among educational leaders and teachers. The mean values indicate that more academic leaders (mean = 3.73) have behavioural intentions for technology integration than teachers (mean = 3.59). However, the mean difference (-.13714) is small and insignificant (p> .05). This indicates that there is no significant difference in behavioural intentions regarding the integration of technology into the curriculum by role.

Table 4: Statistical difference between Educational Leaders and Teachers regarding behavioral intention to integrate technology integration

Job Title/Position	Mean	Std. Deviation	t	df	Sig.	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
								Lower	Upper
Teacher	3.59	.617	-1.159	177	.248	-.13714	.11832	-.37064	.09637
Academic Leader	3.73	.672							

Research Question 4: *Is there any relationship between the availability of technology (resources and equipment, accessibility) and stakeholders' perceptions about the integration of technology in education?*

Table 5 (*see Appendix*) includes the statistical results of correlation between teachers' technology integration, availability of technology resources, equipment and accessibility, and stakeholders' perceptions about integration technology education. Teachers' efforts toward technology integration have a significant positive correlation with availability of resources (r = .426) and stakeholder perceptions about technology integration (r = .356). Likewise, the availability of technology resources also has a significant positive correlation with stakeholders' perceptions about technology integration education (r = .473). All correlations between these variables are significant ($p < 0.01$). Model 1, which focused on equipment availability, stakeholders' perception and teachers' technology integration has its path coefficient displayed in tabular form in Table 6 (*see Appendix*).

Table 5: Correlation between Teachers' technology integration, availability of technology (resources and equipment, accessibility) and stakeholders' perceptions about integration technology education (N = 179)

Correlations				
		Teachers' Technology Integration	Availability of Technology resources	Stakeholders' perceptions about integration technology education
Teachers' Technology Integration	Pearson Correlation		.426**	.356**
	Sig. (2-tailed)		.000	.000
Availability of Technology resources	Pearson Correlation			.473**
	Sig. (2-tailed)			.000
Stakeholders'	Pearson Correlation			

perceptions about integration technology education	Sig. (2-tailed)			

**. Correlation is significant at the 0.01 level (2-tailed).

Table 6: Path coefficients in Model 1 (Equipment availability, Stakeholders' perceptions and Teacher technology integration)

	Original Sample (O)	Sample Mean (M)	Standard Deviation (STDEV)	T Statistics (|O/STDEV|)	P Values
Equipment/ Facilities/ Support -> Stakeholders' Perceptions	0.612	0.618	0.052	11.868	0.000
Equipment/ Facilities/ Support -> Teacher Technology Integration	0.307	0.304	0.108	2.852	0.005
Stakeholders' Perceptions -> Teacher Technology Integration	0.082	0.09	0.103	0.798	0.425

Figure 1 (*see Appendix*) illustrates the model of path coefficients between equipment availability, stakeholders' perceptions and teachers' technology integration. The factor loading of all sub-factors within constructs are above 0.60, which is considered as good convergence within each variable (White, 2012). The model shows that the availability of technological resources, equipment and accessibility have a strongly positive effect on stakeholders' perceptions (β = 0.61), while resources have an average positive effect on teacher technology integration (β = 0.30). The effects are significant at the 0.05 level (p< .001 and .005, respectively), as shown in Table 6. The T statistic is above 2.000, which is considered an acceptable effect size (Chin, 1998). Stakeholders' perceptions have an insignificant (p = 0.425) weakly positive effect (β = 0.08) on teachers' technology integration. In this case, the T statistics also did not reach minimum criteria for an acceptable effect size.

Figure 1. Model 1 (Equipment availability, Stakeholders' perceptions and Teacher technology integration)

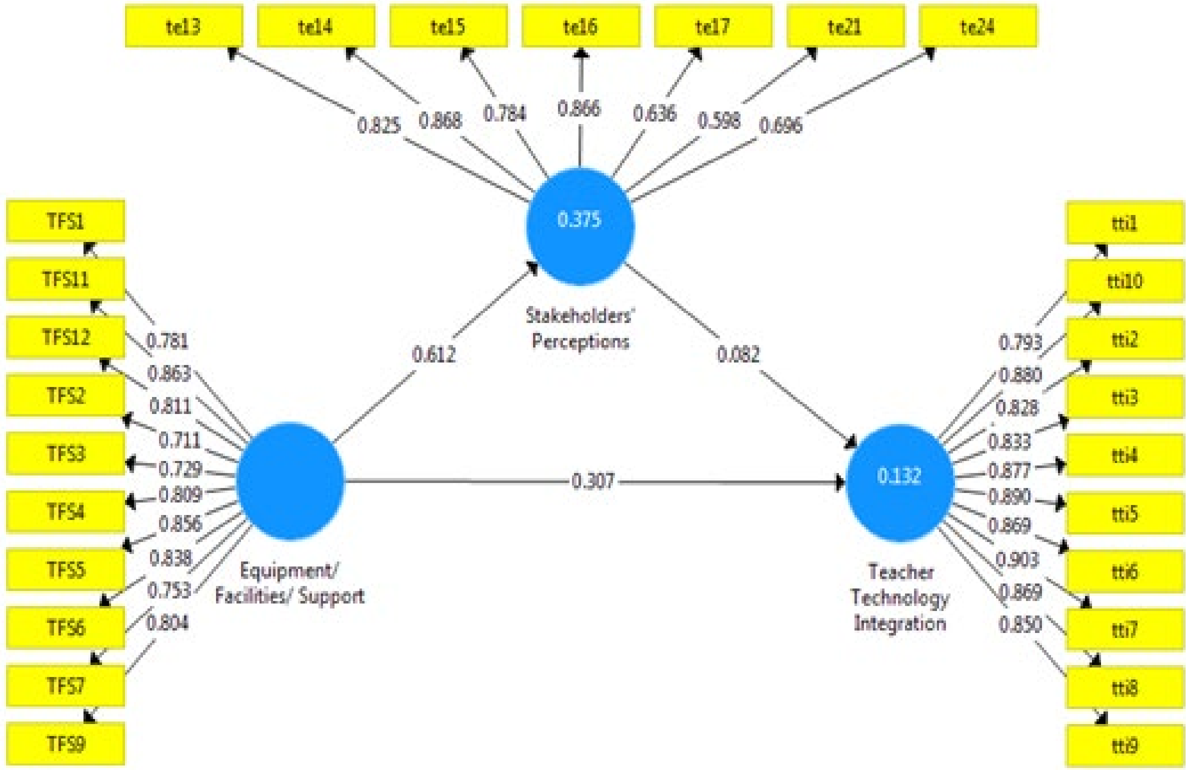


Table 7 (*see Appendix*) offers information regarding the construct reliability and validity of the scales within Model 1. The construct reliability of three scales, 'Equipment availability', 'Stakeholders' perceptions' and 'Teachers' technology integration' is above 0.85, which is considered good (Hair et al., 2010). The AVE also shows the excellent construct validity of these scales (AVE > .50; Hair et al., 2010). Similarly, good discriminant validity was found for the scales 'Equipment availability', 'Stakeholders' perceptions' and 'Teachers' technology integration', as the coefficient value of each prescribed scale is higher with itself than its coefficient with other scales (Table 8 (*see Appendix*)). The statistics in Tables 9 (*see Appendix*) and 6 indicate the good fit of Model 1.

Table 7: Construct reliability and validity of Model 1 (Equipment availability, Stakeholders' perceptions and Teacher technology integration)

	Cronbach's Alpha	rho_A	Composite Reliability	Average Variance Extracted (AVE)
Equipment/ Facilities/ Support	0.936	0.942	0.946	0.635
Stakeholders' Perceptions	0.874	0.884	0.904	0.578
Teacher Technology Integration	0.961	0.965	0.966	0.739

Table 8: Discriminant validity of Model 1 (Equipment availability, Stakeholders' perceptions and Teacher technology integration)

	Equipment/ Facilities/ Support	Stakeholders' Perceptions	Teacher Technology Integration
Equipment/ Facilities/ Support	0.797		
Stakeholders' Perceptions	0.612	0.76	
Teacher Technology Integration	0.358	0.27	0.86

Table 9: Model fit Indices (Equipment availability, Stakeholders' perceptions and Teacher technology integration)

	SSO	SSE	Q^2 (=1-SSE/SSO)	R Square	SRMR	NFI
Stakeholders' Perceptions	1,253.00	1,005.61	0.197	0.375	0.06	.831
Teacher Technology Integration	1,790.00	1,636.45	0.086	0.132		

Research Question 5: *Is there any relationship due to mission, vision, values, goals of TVTC, and stakeholders' perceptions about the effective integration of technology in education?*

Correlations between mission, vision, values, goals of TVTC, and stakeholders' perceptions about effective integration of technology in education are provided in Table 10 (*see Appendix*). Pearson's correlation indicates that there is a strong positive correlation ($r = .67$) between the two prescribed variables; this is significant at the .001 level ($p< .001$). Model 2 was derived from this research question (Figure 2 and path coefficient in Table 11 (*see Appendix*)).

Table 10: Correlation due to mission, vision, values, goals of TVTC, and stakeholders' perceptions about effective integration of technology in education (N = 179)

Correlations			
		Mission, Vision, Values, and Goals of TVTC	Stakeholder's perceptions about integration technology education
Mission, Vision, Values, and Goals of TVTC	Pearson Correlation		.672**
	Sig. (2-tailed)		.000
Stakeholder's perceptions about integration technology education	Pearson Correlation		
	Sig. (2-tailed)		

Figure 2. Model 2 (Mission, vision, values and goals of TVTC, and Stakeholders' perceptions about technology integration in education)

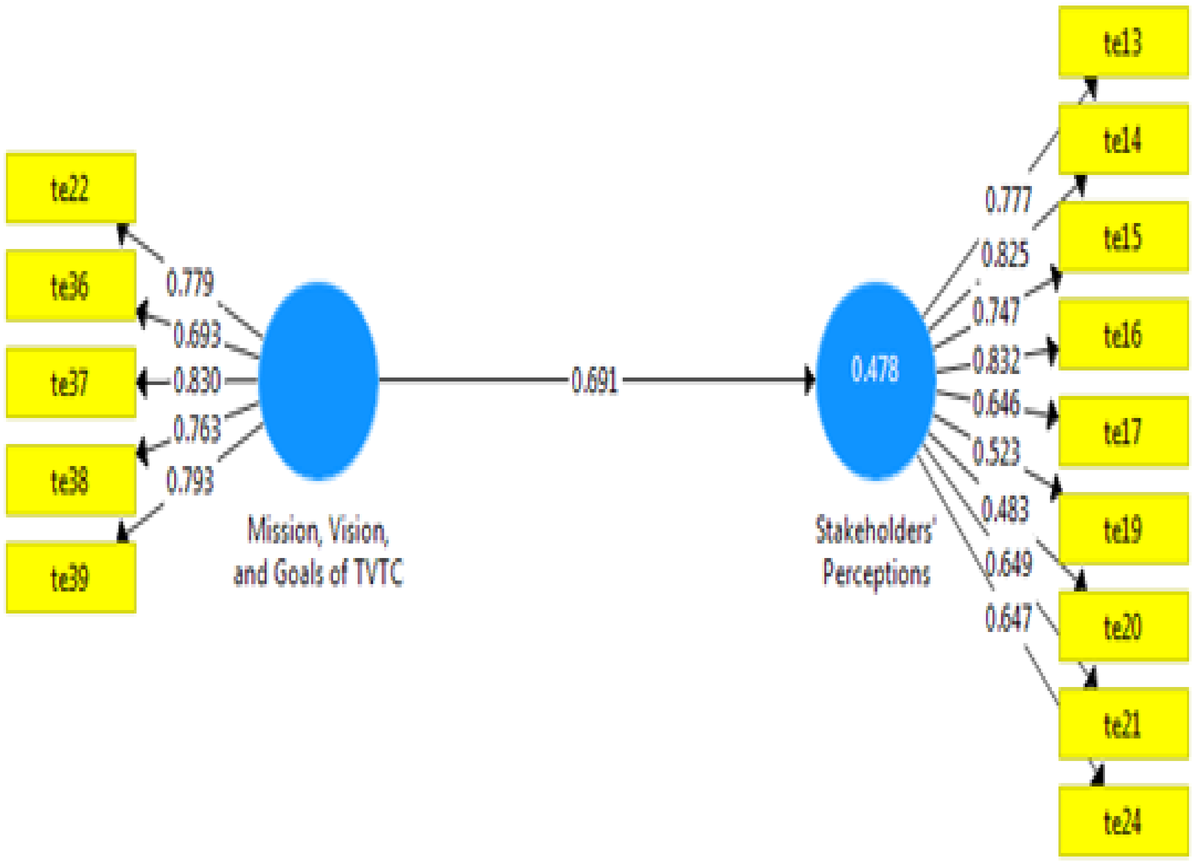


Table 11: Path coefficient (Mission, vision, values and goals of TVTC, and Stakeholders' perceptions about technology integration in education)

	Original Sample (O)	Sample Mean (M)	Standard Deviation (STDEV)	T Statistics (|O/STDEV|)	P Values
Mission, Vision, and Goals of TVTC -> Stakeholders' Perceptions	0.691	0.699	0.039	17.555	0.000

The mission, vision, values and goals of TVTC, and stakeholders' perceptions about technology integration were studied against stakeholder perceptions on how technology education is integrated. The graphical representation of the model of path coefficient between mission, vision, the values and goals of TVTC, and stakeholders' perceptions about the integration of technology education have been shown in Table 12. Factor loading of all sub-factors within constructs are above .005, which is considered as acceptable convergence within each variable (White, 2012). The model shows that the mission, vision and goals of the TVTC have a highly positive effect (β = 0.691) on the perceptions of stakeholders towards technology integration. Moreover, this effect is significant at .001 level (p< .001) and the T statistic is 17.555 (> 2.000), showing an excellent effect size (Table 11).

The construct reliability and validity of the scales within model 2 are outlined in Table 12 (see *Appendix*). The construct reliability of two scales, namely 'Mission, vision, values and goals of TVTC' and 'Stakeholders' perceptions' is above .80, considered good (Hair et al, 2010). The AVE also shows the excellent construct validity of the prescribed scales (AVE > .50; Hair et al., 2010). The scales, 'Mission, vision, values and goals of TVTC' and 'Stakeholders' perceptions' have good discriminant validity according to White (2012), as the coefficient value of each prescribed scale is higher with itself than its coefficient with other scales which indicate a positive correlation (Table 13 (*see Appendix*)). Values given in Tables 14 and11 (*see Appendix*) highlight the good fit of Model 2, as all indices come within criterion range of fitness (Q-Square < 1.00, R^2 > .30, T-statistic > 1.96 and p-value < .05, NFI > 0.50 given by Chin (1998) and Hair et al. (2010).

Table 12: Construct reliability and validity of Model 2 (Mission, vision, values and goals of TVTC, and Stakeholders' perceptions about technology integration in education)

	Cronbach's Alpha	rho_A	Composite Reliability	Average Variance Extracted (AVE)
Mission, Vision, and Goals of TVTC	0.834	0.85	0.881	0.597
Stakeholders' Perceptions	0.856	0.864	0.889	0.578

Table 13: Discriminant validity of M\\\odel 2 (Mission, vision, values and goals of TVTC, and Stakeholders' perceptions about technology integration in education)

	Mission, Vision, and Goals of TVTC	Stakeholders' Perceptions
Mission, Vision, and Goals of TVTC	0.773	
Stakeholders' Perceptions	0.691	0.695

Table 14: Model fit indices (Mission, vision, values and goals of TVTC, and Stakeholders' perceptions about technology integration in education)

	SSO	SSE	Q^2 (=1-SSE/SSO)	R square	SRMR	NFI
Stakeholders' Perceptions	1,611.00	1,283.90	0.203	.475	0.11	0.715

Research Question 6: *What influence does teacher preparation programs at the university level have on stakeholders' perceptions and intentions toward technology integration?*

The correlation of teacher preparation programs at the university level with stakeholders' perceptions and behavioural intentions regarding technology education integration has been shown on Table 15 (*see Appendix*). The results indicate that teacher preparation programmes at university have a high positive correlation with their perceptions (r = .662), significant at the .001 level (p< .001. In contrast, it has a moderate positive correlation (r = .477) with stakeholders' behavioural intentions toward technology integration, significant at the 0.01 level (p<.001). Stakeholders' perceptions and intentions for technology education integration are also highly correlated with each other and significant at the .001 level (p<.001).

Table 15: Correlation of Teacher Preparation Programs at the University with their perception and Behavioural intention toward integration of technology in education (N = 179)

Correlations				
		Teacher Preparation Programmes at the University	Stakeholder's perceptions about integration technology education	Behavioural Intentions
Teacher Preparation Programmes at the University	Pearson Correlation		.662**	.477**
	Sig. (2-tailed)		.000	.000
Stakeholder's perceptions about integration technology education	Pearson Correlation			.606**
	Sig. (2-tailed)			.000
Behavioural Intentions	Pearson Correlation			
	Sig. (2-tailed)			

**. Correlation is significant at the 0.01 level (2-tailed).

Model 3 illustrating the influence of teacher preparation programs at the university level on stakeholders' perceptions and intentions towards technology integration is shown in Figure 3 (*see Appendix*). The factor loadings of all sub-factors within constructs are above 0.50, which is considered acceptable convergence (Hair et al., 2010). The model indicates that teacher preparation programs have an above-average effect (β = .535) in developing behavioural intentions among stakeholders, and they are highly influential (β = .670) on favourable perceptions of technology integration in education among stakeholders. Table 16 describes the statistical significance of these effects; these data show that teacher preparation programs significantly influence stakeholders' perceptions and behavioural intentions toward technology education integration. The T statistics (9.135 and 15.359, respectively) suggest a good effect size.

Figure 3. Model 3 (Influence of Teacher preparation programmes at University on stakeholders' perceptions and intentions for technology integration)

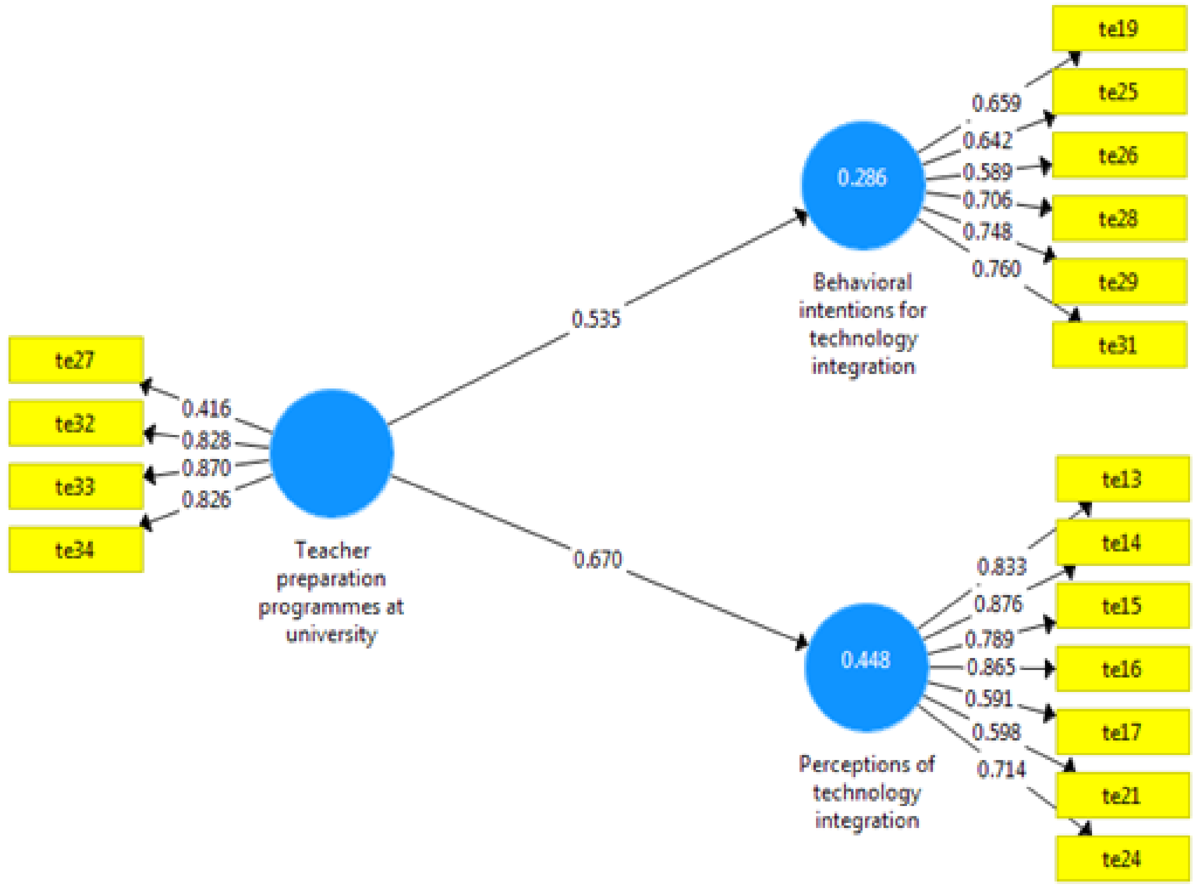


Table 16: Path coefficients (Influence of Teacher preparation programmes at University on stakeholders' perceptions and intentions for technology integration)

	Original Sample (O)	Sample Mean (M)	Standard Deviation (STDEV)	T Statistics (|O/STDEV|)	P Values
Teacher preparation programmes at university -> Behavioural intentions for technology integration	0.535	0.549	0.059	9.135	0.000
Teacher preparation programmes at university -> Perceptions of technology integration	0.67	0.676	0.044	15.359	0.000

The values of construct reliability and validity of scales within Model 3 are provided in Table 17 (*see Appendix*). The construct reliability of the scales, 'Teacher preparation programs at university', 'stakeholders' 'perceptions of technology integration' and 'behavioural intentions toward technology integration' is above .70, which is considered acceptable according to Hair et al (2010). The AVE indicates excellent construct validity of prescribed scales (AVE > .50; Hair et al., 2010).

Table 17: Construct reliability and validity of Model 3 (Influence of Teacher preparation programmes at University on stakeholders' perceptions and intentions for technology integration)

	Cronbach's Alpha	rho_A	Composite Reliability	Average Variance Extracted (AVE)
Behavioural intentions for technology integration	0.774	0.782	0.841	0.571
Perceptions of technology integration	0.874	0.89	0.904	0.578
Teacher preparation programmes at university	0.73	0.795	0.836	0.575

The good discriminant validity of three scales included in Model 3, namely 'Teacher preparation programmes at university', 'stakeholders' perceptions of technology integration' and 'Behavioural intentions for technology integration', is demonstrated by the data in Table 18 (*see Appendix*). Each of the scales has higher coefficient values with itself versus its coefficient with other scales. The results of model fitness testing, as given in Table 19 (*see Appendix*), show the quality of the developed model regarding the influence of teacher preparation programs at university on stakeholders' perceptions and intentions toward technology education integration. Values are far above the thresholds (Q-Square < 1.00, R Square>.30, T Statistics>1.96 and P value< .05) given by Chin (1998) and Hair et al. (2010).
Furthermore, we present the responses generated in assessing different scenarios as regarding what extent integrating technology into TVE as identified through the analysis of the respondents of the interview. The sequence of repeated themes was extracted from the data obtained to answers each of the six questions.

Table 18: Discriminant validity of Model 3 (Influence of Teacher preparation programmes at University on stakeholders' perceptions and intentions for technology integration)

	Behavioural intentions for technology integration	Perceptions of technology integration	Teacher preparation programmes at university
Behavioural intentions for technology integration	0.686		
Perceptions of technology	0.561	0.761	

integration			
Teacher preparation programmes at university	0.535	0.67	0.758

Table 19: Model fit Indices (Influence of Teacher preparation programmes at University on stakeholders' perceptions and intentions for technology integration)

	SSO	SSE	Q^2 (=1-SSE/SSO)	R square	SRMR	NFI
Behavioural intentions for technology integration	1,074.00	942.661	0.122	0.286	0.09	0.74
Perceptions of technology integration	1,253.00	954.966	0.238	0.448		

Question 1: Is the strategic plan of the Technical and Vocational Training Corporation (TVTC) the introduction and integration of technology in training? How?

Based on the responses of the respondents, the majority of the respondents agrees that the general organisation for technical and vocational training strategic plans actually amounts to the introduction and integration of technology in training through developed curriculums, and the development of technical and professional trainers. Excerpts from respondents are as follows:

"Yes through developed curriculum."
"Yes through the qualification and development of technical and professional trainers."
"Yes, development and courses."

Question 2: Technology has recently been taught as a separate course in different countries. Do you think this is a good idea, and if so, why?

Respondents who answered YES

Respondents who answered NO

In tackling technology being taught as a separate course or not, the responses analysis shows that 20 respondents settle for yes while 8 did not support such. Some of the respondents show as thus:

"Yes, it's a good idea to keep up with evolution."
"Yes, to keep pace with the requirements of the technical age and development in the technical fields."

Respondents that had a different view were more of the opinion that it should be incorporated into courses.

Question 3: Can the curricula of current colleges and institutes eradicate technological illiteracy and find a technically educated trainee, if so, how?"

Respondents who answered YES

Q3b: Respondents who answered NO

The potency of current colleges and institution curricula in eradicating technological illiteracy received a positive backing from the populace by settling for yes with attention on training as a viable means of how this can possibly be. The quotes below are from some of the respondents that have positive responses:

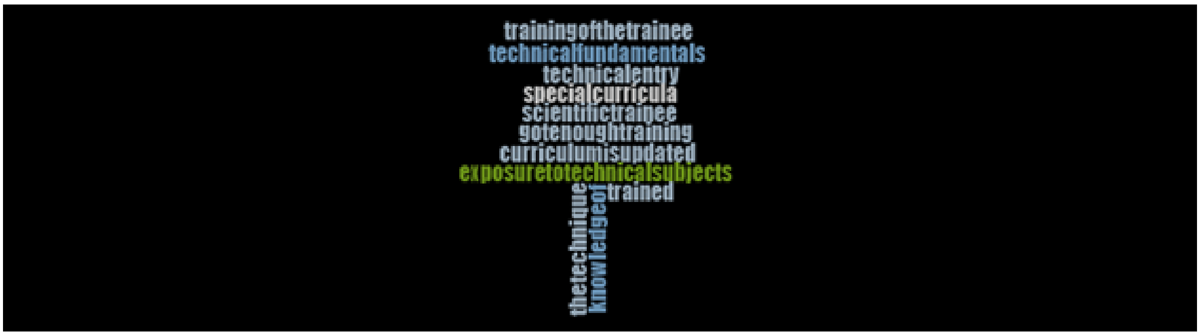
"Yes, to intensify the education of advanced technologies and the development of modern training programs and bring modern equipment and tools."

"Yes, providing technical training on all new technology and increasing the technical culture of the trainee."

Training courses and training the trainers are other leading words in the word count of the respondents. On the contrary, a very small fraction of the respondents that had a different perspective agreed that outdated curriculum is one of the reasons why it might be difficult for colleges and institutions curricula to eradicate technological illiteracy.

Question 4: Do you think that graduates of colleges and institutes have the competencies to enable them to use modern technology in the labour market, and why?"

Respondents who answered YES



Respondents who answered NO

In finding the match between the skills imparted in schools and the skills demanded in the work environment, the gap between the responses was not too wide. 12 of the respondents agreed that students do not have what it takes to actually deliver in the labour market while 15 of the respondents concurred that students from colleges and institutions have what it takes.

Question 5:

The efficiency of the infrastructure and technology made available in the colleges and institutions for the integration of technology into education was also considered in the interview, a larger part of the respondents were of the view that the infrastructure is not available, while in some other regions, their responses were that the technology currently available is excellent. Some rated the available technology as 50% while some rated it 75% availability. In the responses of one of the respondents that have been privileged to have the idea of what is obtainable in one or more areas, it was noted, “They vary from place to place and from college to college”.

Question 6: Do you think that teaching technology and integrating it into the curriculum corresponds to the Kingdom's educational and economic vision in (2030), how?"

Word	Length	Count	Weighted Percentage (%)
Build a technical generation	25	1	10.00
Compatibility with global trend	28	1	10.00
Drive development	16	1	10.00
Efficient use of resources	23	1	10.00
Initiatives based on technology	28	1	10.00
Keeping pace with rapid development	31	1	10.00
Kingdom's development and competition	34	1	10.00
Newly opened specialties	22	1	10.00
More efficient use of technology	30	1	10.00
Visibility of the trainee	22	1	10.00

Considering the role of teaching technology and integrating it into the curriculum corresponds to the Kingdom's educational and economic vision in 2030, the respondents unanimously gave yes as their responses that it aligns with the 2030 vision, but the reasons in backing up their responses differ. Two of the respondents' view are presented below:

"Yes, because the vision depends on keeping pace with the rapid development in the world and simulating everything new in the world of technology and artificial intelligence."

"Yes, attention to cyber security and the orientation for the localisation of technical functions is consistent with vision."

Respondents' views for questions are presented in Appendix II.

Discussion

Successful TVE implementation procedures requires expertise and knowledge of stakeholders. The results of this study indicate that all groups of stakeholders possess a clear perception of effective technology education integration. For instance, educational leaders and teachers have high levels of technological awareness. The findings reveal the readiness and willingness of technology practitioners who are educational stakeholders to effectively integrate technology education into the curricula of technical and vocational education.

Teachers and academic leaders agree that technology is important for both students and trainers. Thus, it should be the part of the curriculum. These results are similar to those identified in the literature. For example, Maninger and Anderson (2007) explained that stakeholders' perceptions of the integration of technology into basic education was relatively high and positive. They also found that stakeholders appreciated the capabilities of different technologies in enhancing the teaching–learning process up to elementary school level (Adedoja, 2016).

The majority of stakeholders indicated a willingness to integrate technology in education. This is also supported by the statements of policymakers and stakeholders with regard to the significant increase in technology use as an integral part of everyday Saudi life. Their results highlight the expanding consumption of technology in Saudi Arabian society (Communications and Information Technology Commission, 2011). Previous researchers concluded that this pattern mirrors the worldwide need for technology usage as a global power (Poorfaraje et al., 2011), because new generations of learners are already very familiar with technology due to its role in their daily lives (Rogers, 2007).

This study also identified the behavioural intention of educational leaders and teachers toward the integration of technology education, which was insignificant. These results are parallel with previous studies, which revealed that very few of the teachers consider technology as capable of increasing poise among students (Davies and West, 2014).

The current study also revealed a significant correlation among stakeholders' perceptions about the integration of technology education integration in the general curriculum, teachers' technology integration, and the availability of technology (resources and equipment, accessibility). Similarly, Davies and West (2014) also found a significant increase in technology (i.e., computer and internet) access, availability, use and integration in the academic sector.

Many previous studies focused on need of technology to enhance learning (Li, 2007). In contrast, the present study found that stakeholders' perceptions about the integration technology education has a minor effect on teachers' technology integration and the effect of availability of technology (resources and equipment, accessibility) is insignificant.

This study found that the mission, vision, and goals of TVTC have a significant and positive effect on the perceptions of stakeholders regarding technology integration. These results are parallel with the findings of Li (2007), who found that vision and mission of technology integration affect outcomes in the classroom level. Otherwise, technology integration will remain isolated to investments and training sessions. Means and Olson (1997) advised educational experts to have a clear statement of mission and vision before investing and spending on technology integration.

The results of this study suggest that teacher preparation programs at university have an above-average effect in developing behavioural intentions among stakeholders. Consequently, Davies and West (2014) highlighted that most educational institutions (i.e., universities, colleges and schools) support their teachers to participate in professional development activities. Changing teachers' attitudes towards integration of technology in education is the prominent goal of teacher development.

Conclusion

The government of Saudi Arabia is planning to integrate technology education into the general curriculum. This study highlighted that stakeholders are fully aware of the importance and implementation strategies of Technical and Vocational Training Corporation (TVTC). However, technology education is not yet fully integrated in the curriculum, making it difficult for teachers to implement these goals at the classroom level. In addition, the study found strong relationships between mission, vision, availability of resources, teacher preparation, and teachers' technology integration. This indicates the necessity of a clear mission and vision combined with teacher's preparation programs at the university level.

Limitations and Future Recommendations

This study has several limitations which provide an opportunity for future researchers. First of all, the data for study was only collected from teachers and administrators of TVTC in Saudi Arabia. This limitation could be addressed in future studies by gathering data from any other country. Moreover, a comparative study can be carried out by gathering data from developed and developing countries. Secondly, future studies can refine the study framework by incorporating variables of hierarchical change management or knowledge management.

REFERENCES

Achoui, M. M. (2009). Human resource development in Gulf countries: an analysis of the trends and challenges facing Saudi Arabia. Human Resource Development International, 12(1), 35-46.

Adedoja, G. (2016). The influence of age and educational qualification on stakeholder's perception of integrating mobile technology into basic education in Nigeria. *African Research Review*, *10*(3), 96-110.

Al Sulaimani, A. (2010). The importance of teachers in integrating ICT into science teaching in intermediate schools in Saudi Arabia: A mixed methods study.

Alghamdi, A. K. (2017). The effects of an integrated curriculum on student achievement in Saudi Arabia. Eurasia Journal of Mathematics, Science and Technology Education, 13(9), 6079-6100.

Al-Hatriti, A., & Al-Mazroa, H. (2013). *Effectiveness of integrating learning cycle and concepts mapping in developing achievement in science and developing critical thinking skills.* Retrieved from http://ecsme.net/MyFiles/rem5.pdf

Almalki, G., & Williams, N. (2012). A strategy to improve the usage of ICT in the Kingdom of Saudi Arabia primary school. *International Journal of Advanced Computer Science & Application*, *3*.

Almutairi, A. S. (2015). Technology education in Saudi Arabia in comparison with New Zealand: a study of policy, curriculum and practice in primary education.

Benson, C., & Lunt, J. (Eds.). (2011). *International handbook of primary technology education: Reviewing the past twenty years* (Vol. 7). Springer Science & Business Media.

Case studies towards transformative practice. The WAC Clearinghouse/Parlor Press.

Chin, W. W. (1998). The partial least squares approach to structural equation modeling. *Modern methods for business research*, *295*(2), 295-336.

Davies, R. S., & West, R. E. (2014). Technology integration in schools. In *Handbook of research on educational communications and technology* (pp. 841-853). Springer, New York, NY.

De Vries, M. J. (Ed.). (2018). *Handbook of technology education*. Springer.
Dogan, İ. (2018). *Examination of the Technology Leadership Self-Efficacy*

De Vries, M. J., van Keulen, H., Peters, S., & van der Molen, J. W. (Eds.). (2012). *Professional development for primary teachers in science and technology* (Vol. 9). Springer Science & Business Media.

Den Hertog, P., & Bilderbeek, R. (2000). The New Knowledge Infrastructure: The Role of Technology-Based Knowledge-Intensive Business. *Services and the knowledge-based economy*, 222.

EL-Deghaidy, H., Mansour, N., Alzaghibi, M., & Alhammad, K. (2017). Context of STEM integration in schools: Views from in-service science teachers.

Forret, M., Edwards, R., Lockley, J., & Nguyen, N. H. (2013). Pre-service teachers' perceptions of technology and technology education.

Foster, J., Kelley, P., Pritz, S., & Hodes, C. (2011). CTE's Focus on Continuous Improvement. *Techniques: Connecting Education and Careers (J1)*, *86*(4), 28-31.

Hair, J. F., Black, W. C., Babin, B. J., & Anderson, R. E. (2010). Multivariate data analysis: Global edition.

Hopken, G. (2008). Technology Teacher Education in Germany. *International Technology Teacher Education*, *19*, 69.

Li, Q. (2007). Student and teacher views about technology: A tale of two cities?. *Journal of research on Technology in Education*, *39*(4), 377-397.

Maninger, R. M., & Anderson, S. E. (2007). Beyond skills: Evaluating the impact of educational technology instruction. *ESCIENTIAE RERUM*, 122.

Means, B., & Olson, K. (1997). *Technology and education reform: Studies of education reform*. Diane Publishing.

Murata, S., & Stern, S. (1993). Technology Education in Japan. *Journal of Technology Education*, *5*(1), 29-37.

Poorfaraj, A., Samimi, A. J., & Keshavarz, H. (2011). Knowledge and economic growth: Evidence from some developing countries. *Journal of Education and Vocational Research*, *1*(1), 21-25.

Washbon, J. L. (2012). Learning and the new workplace: Impacts of technology change on postsecondary career and technical education. *New directions for community colleges*, *2012*(157), 43-52.

White, K. A. (2012). *A qualitative analysis and comparison of the educational technology diffusion and attitudes toward adopting computing technologies, of the Ministry of Education, principals/vice-principals, and teachers, in Jamaican public primary and secondary schools* (Doctoral dissertation, Polytechnic Institute of New York University).

Wright, G. A., Reeves, E., Williams, J., Morrison-Love, D., Patrick, F., Ginestié, J., & Graube, G. (2018). Abridged International Perspectives of Technology Education and Its Connection to STEM Education.