International Journal of Vocational Education and Training

Volume 19
Number 2
2011

Davison M. Mupinga
Editor

Official Publication of the
InternationalVocational Education and Training Association

International Journal of Vocational Education and Training

Volume 19, Number 2

The *International Journal of Vocational Education and Training* is the official refereed publication of the International Vocational Education and Training Association (IVETA). It is published bi-annually and sent to members and subscribers. Regular individual membership dues are US $50.00 per year. For subscription information, change of address, or to purchase additional copies of the journal, contact Barbara Ann Herrmann, Executive Secretariat, IVETA, 186 Wedgewood Drive, Mahtomedi, MN 55115. Phone her at 651-770-6719 or email her at iveta@visi.com.

ISSN: 1075-2455

International Journal of Vocational Education and Training

Volume 19, Number 2

International Journal of Vocational Education and Training
Volume 19 • Number 2 • 2011

Table of Contents

Articles

As a refereed journal, the *International Journal of Vocational Education and Training* depends on qualified individuals to serve as manuscript reveiwers. We send feature article manuscripts to three reviewers. So as not to overwork our reviewers, we need some of you to join us for a one-year term.

If you have a record of publications, research experience, and an interest in gaining additional practice in the use of the Publication Manual of the American Psychological Association, please submit your vita to Dr. Davison M. Mupinga, Editor, International Journal of Vocational Education and Training, School of Teaching, Learning, and Curriculum Studies, College of Education, Health and Human Services, Kent State University, P.O. Box 5190, 316 White Hall, Kent, OH 44242-0001, USA, Email: dmupinga@kent.edu.

Message From the Editor

Like other educational programs, technical and vocational education and training (TVET) continue to be influenced by the economic, societal and technological changes affecting today's world. One of the pressing challenges for TVET has been redirecting its programs to respond to the global forces driving change in this knowledge-based era. Fortunately, for the most part, TVET has responded accordingly and continues to change to meet the needs of evolving societies. Through publications such as newsletters (practitioner reports) and journal articles, the field of TVET has been continually kept up-to-date on current and best global practices. Consequently, this IJVET issue is another collection of research and practitioner reports on current TVET issues of interest. From a global perspective, these articles attempt to provide insights into implementation of TVET, examine TVET policies and practices, describe new TVET competencies, as well as examine the role of information and communication technologies in TVET. Also discussed from a practitioner focus is the implementation of reading, a new TVET content area.

The first article re-assessed high school tracking effects on educational attainment, with a focus on addressing bias from non-random selection into curriculum tracks. This study reaffirms the effectiveness of career-technical education (CTE) in increasing high school completion rates. The second article identified the core strengths of CTE programs providing preparation for state licensure exams. In the third article, the changes to technology education due to information and communication technologies and changes in instructional methods are addressed. Furthermore, the article suggests instructional methods appropriate at the secondary and post-secondary school levels. With reference to developing countries, the fourth article discusses issues to consider when conducting a workforce supply analysis and provides examples of useful resources. The fifth article clarifies core concepts and components of the affective domain, reviews current affective taxonomies for a consistent and comparable evaluation framework, as well as synthesize existing affective intervention areas important in TVET. At a time when organizations are finding it hard to fill positions, employee turnover has become an issue of concern. The sixth article reviews selected literature on the antecedents and consequences of turnover, and summarizes the major antecedents of turnover. As technology changes, so do the skills for today's employees. Consequently, article seven identifies the technical skills needs of service personnel for effective

maintenance of modern automobiles and provides a review of technical college curriculum. In the last article, the need for teaching reading in TVET is addressed by suggesting the use of Fluency Development Lesson (FDL) to teach reading skills. The bottom line is that these articles provide opportunities for dialogue on some of the pertinent issues affecting TVET.

Once again, readers are reminded that articles published in IJVET come from all over the world and as such some authors do not speak English as their first language. While great care has been taken to correct the verbiage, there may be some errors that went unnoticed. Like other past IJVET issues, the journal continues to touch on timely and relevant TVET issues. As I prepare to hand over the journal to a new editor, I wish to thank all the reviewers, authors, and specifically the editorial staff, Jennifer Schneider and Lynda Paul, who have worked tirelessly in the production of IJVET for the past three years. Please note that the articles in this journal do not reflect the position of the journal's editorial staff, reviewers, or policy of IVETA.

Davison M. Mupinga
IJVET Editor

Greatly Underestimated: The Role of Vocational Curriculum Tracks in U.S. High Schools

Sinan Gemici
National Centre for Vocational Education Research, Australia

Abstract

Decades of research on the outcomes of curriculum tracking in the United States have produced inconsistent results, mainly due to insufficient attention to selection bias. Data from the NLSY97 were used to conduct a re-assessment of high school tracking effects on educational attainment, with a particular focus on addressing bias from non-random selection into curriculum tracks. Career-technical education and college-preparatory tracks produced favorable outcomes at distinct attainment levels when compared to general tracks. Results indicate a need to qualify blanket assumptions about the advantages of college-preparatory tracks for all students. Moreover, results support a growing body of literature that considers career-technical education an effective option to increase high school completion rates as an important precursor to postsecondary educational attainment.
Keywords: *educational attainment, curriculum tracking, post-school transition, career-technical education, vocational education and training*

Introduction

Almost thirty years ago, *A Nation at Risk* (National Commission on Excellence in Education, 1983) highlighted the relative decline in America's ability to compete with a rising tide of well-educated and highly-motivated workers abroad. The authors' key message was that "others are matching and surpassing our educational attainments" (para. 1). This warning was echoed by a series of high-profile reports that emerged throughout the 1990s and into the new millennium (e.g., National Center on Education and the Economy, 1990, 2007; U.S. Department of Education, 2008). Collectively, these reports underscored the critical need to raise educational attainment levels and prepare American youth for a knowledge-based economy.

One policy response to the attainment challenge resulted in the passage of federal legislation aimed at reforming secondary career-technical education (CTE; outside of the U.S. commonly referred to as *vocational education and training*). Reform efforts were codified in the Carl D. Perkins Vocational and Applied Technology Act of 1990 (hereafter *Perkins 1990*) which, for the first time, issued a clear mandate for high school CTE programs to reinforce the transition to postsecondary education for traditionally work-bound youth. Overall, the comprehensive reform of the high school CTE curriculum sought to raise workforce productivity and individual employment options by creating new pathways toward higher educational attainment (Foster, 2007). Subsequent reauthorizations of Perkins legislation in 1998 and 2006 further intensified the focus on transition to postsecondary education by integrating more stringent academic course requirements into the high school CTE curriculum.

Educational Attainment

The positive effects of educational attainment on economic growth and individual earnings are manifest in the literature (Barro, 2001). Trend data on U.S. income levels for the period from 1975 to 2006 illustrate these effects. Measured in constant 2006 dollars, income for high school graduates rose by six percent while individuals with some college education earned 10 percent more (Swanson, 2009). The largest raises were experienced by individuals holding bachelor's (23%) and graduate or professional degrees (31%). Against this backdrop, the current state of educational attainment in the U.S. is ambivalent. On one hand, *nominal* educational attainment increases have been remarkable. The U.S. population has experienced a three-fold increase in high school attainment since 1940, accompanied by a five-fold increase in college attainment (Crissey, 2009). On the other, actual attainment rates have not seen sizeable improvements since the early 1980s (Ho & Jorgenson, 1995). The mismatch between nominal and actual attainment growth results from the fact that "much of the increase in schooling since the 1970s is due to the dying out of older generations with comparatively little education, rather than steadily growing educational attainment among younger generations" (Kodrzycki, 2002, p. 39).

A closer examination of U.S. educational attainment reveals unsettling developments. At the high school level, one-third of all students leave without a regular diploma (Barton, 2005). Such excessive dropout rates reflect a waste of talent that has severe personal and societal repercussions. At the college level, the U.S. has moved from a leadership position in educational attainment to occupying tenth place in the age group of 25-to 34-year-olds (OECD, 2009). More disconcerting is the fact that only 17% of all U.S. undergraduate degrees in 2005 were awarded in the areas of science, mathematics, and engineer-

ing, compared to 31% in Germany and 37% in South Korea (Snyder, Dillow, & Hoffman, 2009). The cumulative impact of domestic and international attainment trends affects the competitiveness of the American workforce and intensifies the need to evaluate substantive changes in secondary CTE policy, such as Perkins 1990, for their potential to facilitate high school completion and transition to at least some level of postsecondary education.

Curriculum Tracking

Many American high schools have traditionally followed a three-tiered curriculum structure consisting of CTE, college-preparatory (CP), and general tracks. CTE is considered a pathway to work, whereas CP prepares students for postsecondary education at traditional four-year institutions. Students without distinct CTE or CP concentrations are classified as general-track, which typically denotes an unspecified course sequence that reflects a pseudo-academic concentration (Stone & Aliaga, 2005). For the past two decades, tracking has focused on reducing the heterogeneity of instructional groups by sorting students along an ability continuum of basic, regular, honors, and advanced placement courses. Despite these more subtle differentiation schemes, most students' overall course-taking patterns reflect a de facto reproduction of the traditional three-tiered curriculum structure (Lucas & Berends, 2002).

Numerous studies have addressed the effects of high school curriculum tracking on educational outcomes. Evidence supports the positive impact of CP tracks on academic achievement, high school completion, and postsecondary educational attainment (Horn & Kojaku, 2001; Gamoran & Mare, 1989; Natriello, Pallas, & Alexander, 1989). These findings are unsurprising given that students in CP tracks generally have higher-quality teachers, are surrounded by more academic role models, and benefit from an overall more stimulating academic climate (Hallinan, 2003; Marsh & Raywid, 1994).

A more ambiguous picture has emerged for CTE. Some studies have found CTE to positively impact academic achievement, high school completion, two-year postsecondary enrollment, and employment status for work-bound youth (Arum & Shavit, 1995; Cellini, 2006; Rasinski & Pedlow, 1994; Stone & Aliaga, 2005). Other investigations have ascertained positive secondary and postsecondary attainment effects from integrating CTE and academic courses (Castellano, Stringfield, & Stone, 2003; Plank, DeLuca, & Estacion, 2008). Plank et al. discovered that a 2:1 ratio of core academic-to-CTE courses was associated with minimizing the dropout risk. Students with four or more CTE credits, however, exhibit a reduced likelihood of enrolling in college when compared to those without any CTE credits (Levesque, Laird, Hensley, Choy, Cataldi, & Hudson, 2008).

Not all investigations of high school CTE have ascertained positive effects. Pittman (1991) found curriculum type to be the weakest dropout predictor when compared to school environmental factors, such as student-teacher relationships, peer influences, and the general school climate. More recent work has confirmed the absence of substantive CTE curriculum effects on dropout rates (Agodini & Deke, 2004) and the likelihood of college attendance (DeLuca, Plank, & Estacion, 2006). Notably, conclusions drawn by Pittman as well as Agodini and Deke were based on data reflecting pre-Perkins 1990 reforms.

Purpose

Decades of research on high school tracking outcomes have yielded consistently inconsistent results, especially with regard to CTE. Insufficient attention to selection bias has been identified as one fundamental cause for divergent conclusions in the tracking literature (Lee & Ready, 2009). The purpose of this investigation was to conduct a re-assessment of high school tracking effects on educational attainment, with a particular focus on addressing bias from non-random selection into curriculum tracks. Given the importance of Perkins 1990 as a major policy shift toward facilitating post-school transition for traditionally work-bound youth, outcomes for CTE concentrators were of particular interest.

Method

Sample

Data from the National Longitudinal Survey of Youth 1997 (NLSY97) were used to determine high school tracking effects on educational attainment. The NLSY97 is an annual survey that provides data to examine the transition from secondary to postsecondary education or work. The 1996/97 base year sample of 8,984 respondents was representative of all U.S. residents born between 1980 and 1984. During the base year, 1,852 students were enrolled in the ninth grade of a regular secondary school program. This cohort of ninth graders was used for the present study. Transcript information on high school curriculum track was available for 1,199 individuals. A further 189 cases containing legitimate item skips were removed, along with 84 dual concentrators (i.e., combining CTE and CP high school concentrations). Although an examination of tracking effects for dual concentrators would have been desirable, the available sample size was too small for analysis. The final sample comprised 926 ninth graders of whom 262 were in CTE, 204 in CP, and 460 in general high school tracks. Table 1 provides descriptive data for the sample.

Table 1
Descriptive Data for the Sample (Unweighted)

Variables	*Levels*	*CTE*		*CP*		*General-track*	
		n	*%*	*n*	*%*	*n*	*%*
Gender	Male	164	35.5	73	15.8	225	48.7
	Female	98	21.1	131	28.2	235	50.6
Race/ethnicity	Black	57	24.1	35	14.8	145	61.2
	Hispanic	43	24.6	30	17.1	102	58.3
	Non-Black/Non-Hispanic	162	31.5	139	27.0	213	41.4
School type	Public	253	29.5	172	20.0	434	50.5
	Private and other	9	13.4	32	47.8	26	38.8
Ever suspended from school	No	184	28.4	189	29.2	274	42.3
	Yes	78	28.0	15	5.4	186	66.7

Measures

Covariates. The use of non-random observational data required controlling for selection bias into different high school tracks. Propensity score matching (PSM) was used to address this issue. PSM uses observable covariates that influence treatment participation and the outcome of interest to create balanced comparison groups as a prerequisite for estimating treatment effects. Here, CTE and CP curricula represented mutually-exclusive treatment conditions that were compared separately against the general-track control condition. Specific student and school-level covariates that have been associated with track selection and educational attainment include gender, race/ethnicity, socioeconomic status, urbanicity, academic achievement, work-based learning, special needs status, English language learner status, academic risk behavior, attitudes toward school, peer influences, and school affluence and control (Agodini, Uhl, & Novak, 2004; Berends, 1995; Hanushek, Kain, Markman, & Rivkin, 2003; Jones, Vanfossen, & Ensminger, 1995; Lewis & Cheng, 2006; Neumark & Rothstein, 2006; Silverberg, Warner, Fong, & Goodwin, 2004; Stone & Aliaga, 2005).

Treatments. Treatments categorized an individual's full course-taking behavior in high school as CTE, CP, or general-track. Students in CTE and CP tracks were compared separately against those in general tracks. No direct comparison between CTE and CP was performed because propensity score matching requires a sizeable pool of control cases from which to draw adequate matches. Only the general-track group offered a sufficiently large control group.

Outcome. The outcome variable reflected the highest level of formal education attained by an individual as of 2007. Educational attainment consisted of five categories, including *no high school diploma or GED*[1]*, GED, regular high school diploma, two-year college degree, and four-year college degree.* All measures included in the analysis are outlined in Table 2.

[1]General Educational Development (GED) is a high school equivalency credential. The GED assessment covers aptitude in writing, social studies, science, reading, and mathematics.

Table 2
Measures

Variable	*Categories*	*Missing*	
		n	%
COVARIATES			
Weight[a]	Continuous	0	0
Gender	1=Male; 2=Female	0	0
Race/ethnicity	1=Black; 2=Hispanic; 3=Non-Black/Non-Hispanic	0	0
Urbanicity	0=Rural; 1=Urban	37	4.0
Poverty ratio (square root)	Composite	178	19.2
Grades in grade eight	Continuous	16	1.7
PIAT math standard score	Treated as Continuous	30	3.2
Work-based learning	0=No; 1=Yes	3	.3
Remedial English/math	0=No; 1=Yes	0	0
ESL/bilingual program	0=No; 1=Yes	0	0
Ed/physical handicap	0=No; 1=Yes	0	0
Attitudes toward school[b]	Continuous	6	.6
Number of days absent from school	Continuous	18	1.9
Ever suspended from school	0=No; 1=Yes	0	0
School type	1=Public; 2=Private and other	0	0
Student-teacher ratio	1=<14; 2=14 to <18; 3= 18 to <22; 4=22+	37	4.0
Percent peers college-bound	1=Less than 10%; 2=About 25%; 3=About 50%;4=About 75%; 5=More than 90%)	6	.6
Gender by PIAT[c]	Interaction	N/A	N/A
Poverty ratio by Grades	Interaction	N/A	N/A
TREATMENTS			
CTE	0=No; 1=Yes	0	0
CP	0=No; 1=Yes	0	0
General track	0=No; 1=Yes	0	0
OUTCOME			
Highest Ed. Attainment by 2007	0=No HS or GED; 1=GED; 2=HS Diploma; 3=2-Year College 4=4-Year College	0	0

[a]Survey weights have no effect on bias when estimating a single constant treatment effect. Rather than weighting separately, survey weights were included in the propensity score model as a covariate.
[b]Seven items capturing students' attitudes toward teachers and the school environment were transformed into a continuous composite variable.
[c]Including relevant interaction terms can improve the quality of propensity scores (Rosenbaum & Rubin, 1984). Gender by PIAT and poverty ratio by grades were included in the model (see Linver, Davis-Kean, & Eccles, 2000; Sirin, 2005).

Missing Data

Several pre-treatment covariates contained missing data (see Table 2). Unless handled properly, missing data can result in reduced statistical power or biased parameter estimates. Moreover, simplistic missing data methods such as listwise deletion or mean substitution yield unbiased parameter estimates only when data are missing completely at random (MCAR; see Schafer & Graham, 2002, for a discussion of missing data mechanisms). Results from Little's (1988) MCAR test indicated that data were not MCAR, $\chi^2 = 47.771$, $p = .028$, $df = 31$. Using simplistic missing data methods may thus have biased the analysis. Multiple imputation (MI) was used to address the missing data problem under the less stringent missing at random (MAR) mechanism. Following guidelines by

Schafer (1997), five complete datasets were imputed using *Multiple Imputation by Chained Equations* (MICE; Van Buuren & Groothuis-Oudshoorn, 2009) software. Visual checks of pre and post-imputation datasets showed no noticeable differences in the density distributions of imputed covariates. Each imputed dataset underwent PSM and post-matching data analysis procedures before pooling parameter estimates and standard errors using Rubin's (1987) guidelines.

Propensity Score Matching

Randomized experiments are the gold standard for estimating treatment effects. In the absence of random assignment, PSM allows the creation of balanced comparison groups from non-random observational data. The method can collapse a large number of covariates into a scalar between 0 and 1 that represents the probability of selection into a given treatment. The propensity score itself is defined as

$$e(x) = pr(z = 1|x)$$

where x denotes the vector of covariates for the propensity score model, and the binary variable z indicates exposure to treatment (Rosenbaum & Rubin, 1985). For each individual, the propensity of selection into treatment, $e(x)$, is estimated through logistic regression of z on x, where z equals *1* for the treatment group and *0* for the control group. Once treatment and control cases are matched on the propensity score, the treatment effect can be estimated free of bias from observable covariates. Any unobserved covariate is considered *strongly ignorable* for selection into treatment (Rosenbaum & Rubin, 1983). For details on PSM, readers are referred to Guo and Fraser (2010).

This study represented a multinomial treatment case because it compared educational attainment outcomes for two mutually exclusive treatment conditions (i.e., CTE or CP track) separately against those for the control condition (i.e., general track). Propensity scores were estimated through sequential application of a binomial logit model using the previously specified covariate vector (see Table 2). Nearest-neighbor and Full matching were used to balance treatment and control groups. Nearest-neighbor matching was implemented using a 5:1 control-to-treatment matching ratio to increase the available pool of control cases. A caliper size of .25 times the standard deviation of propensity scores was used to ensure high-quality matches (see Rosenbaum & Rubin, 1985). Full matching was used as a secondary algorithm to confirm consistent matching outcomes. PSM was implemented using *MatchIt* (Ho, Imai, King, & Stuart, 2007) and *psmatch2* (Leuven & Sianesi, 2003) software.

Post-matching Estimation of Tracking Effects

Chi-square analysis was used to determine high school tracking effects on educational attainment. Omnibus tests were followed by cell-wise post-hoc comparisons using adjusted standardized residuals (MacDonald & Gardner, 2000). The experiment-wise Type I error rate was maintained using a Sidak (1967) correction, resulting in a test-wise alpha level of .005 and a two-tailed critical value of $z = \pm 2.80$.

Results

Covariate Balance

The pre-matching CTE vs. general-track sample showed statistically significant differences on seven covariates. Discrepancies within the CP vs. general-track sample were even greater, with 15 of the 20 covariates exhibiting significant differences (Appendix A). Both Nearest-neighbor and Full matching successfully balanced samples across all covariates. Hypothesis tests on the post-matching samples showed no remaining statistically significant covariate differences in either CTE vs. general-track or CP vs. general-track samples (Appendix B). Given journal space limitations, only results from Nearest-neighbor-based samples are shown here. Results from Full matching are consistent with those from Nearest-neighbor matching and are available upon request.

Curriculum Effects

Pooled chi-square statistics, standard errors, and Cramer's *V* effect size coefficients were calculated for all multiply-imputed datasets. Omnibus tests were significant for both CTE vs. general-track and CP vs. general-track samples, with large and medium effect sizes, respectively. Results were consistent across all multiply-imputed datasets (Table 3).

Adjusted standardized residuals were examined through cell-wise post-hoc tests to determine tracking effects by attainment level. For the CTE vs. general-track, post-hoc tests were significant on all three levels of secondary educational attainment. A greater number of general-track students never completed secondary education when compared to CTE students. CTE students obtained a regular high school diploma at higher rates than their general-track peers, who showed higher rates of earning a GED. Overall, results indicated a statistically significant and practically relevant secondary attainment advantage for CTE concentrators compared to general-track students. For the CP vs. general-

Table 3
Chi-square Omnibus Test

Track	*Imputation*	*n*	χ^2	*S.E.*	*df*	*Cramer's V*
CTE vs. General	1	639	59.907***		4	.306
	2	642	55.701***		4	.295
	3	623	53.208***		4	.292
	4	627	68.602***		4	.331
	5	634	66.861***		4	.325
	Pooled	633	60.856***	6.610	4	.310
CP vs. General	1	420	16.045**		4	.195
	2	425	18.266**		4	.207
	3	423	19.543**		4	.215
	4	424	13.077*		4	.176
	5	422	15.809**		4	.194
	Pooled	423	16.548**	2.439	4	.197

Note. Sample size variations resulted from the use of matching ratios and corresponding ratio weights, as well as the use of calipers. Pooled sample sizes were rounded to the nearest integer. Effect size was measured using Cramer's coefficient V, whereby for a 5x2 contingency table V ≥ .250 = large, V between .150 and .249 = moderate, and V < .150 = small effect size (see Cohen, 1988). *p < .05 **p < .01 ***p < .001

Table 4
Pooled Post-hoc Tests

Attainment level	*CTE vs. General-track*		*CP vs. General-track*	
No HS diploma or GED	-4.57*	4.57*	-1.35	1.35
GED	-5.68*	5.68*	-2.31	2.31
Regular HS diploma	5.16*	-5.16*	-2.39	2.39
Two-year college degree	1.38	-1.38	.73	-.73
Four-year college degree	.84	-.84	3.19*	-3.19*

Note. Adjusted standardized residuals exceeding z = ± 2.80 are statistically significant.

track, the number of four-year college degrees completed by CP students was significantly higher than for those in the general-track. Post-hoc tests yielded consistent results across all imputation cycles (Table 4).

Sensitivity Analysis

One potential limitation of PSM is its inability to account for unobserved, yet causally-relevant, concomitants. The exclusion of influential covariates may lead to hidden bias, for two individuals with identical covariate values will have differential odds of treatment assignment due to the impact of an unobserved covariate (Rosenbaum & Rubin, 1983). Sensitivity analysis examines the degree to which effect estimates are undermined by hidden bias. Uncertainty about the impact of unobserved covariates on the parameter estimate is captured by the parameter Γ, and where $e^{\gamma} = 1$ no hidden bias is present (for details on sensitivity analysis, readers are referred to Rosenbaum, 2002). Results for CTE vs. general-track and CP vs. general-track yielded $e^{\gamma} = 2.00$ and $e^{\gamma} = 1.94$, respectively. Overall, sensitivity analysis supported the relative robustness of the propensity score model and resulting inferences.

Discussion and Conclusion

CP

Results from this sample of 1996/97 ninth graders indicate that CP high school concentrations prepare students for four-year college careers more effectively than general-track curricula. This finding is unsurprising and corresponds with the extant literature. However, conclusions about positive CP curriculum effects *in general* are premature given the absence of differential high school dropout rates. The lack of a positive high school completion effect is startling, for it is reasonable to expect the same track-based resource allocation mechanisms that foster CP student attainment at the college level to provide advantages in high school.

The inefficiency of tracking mechanisms offers one possible explanation. CP curricula are geared toward preparing academically able students for the transition to traditional four-year colleges. However, myriad factors besides academic ability influence track assignment, including teacher recommendations, personal choice, parental and peer influences, and school resources. The influence of ancillary factors on tracking decisions may lead to frequent misplacements of lower-achieving students into CP tracks where academic challenges can lead to frustration and eventual dropout.

An alternative explanation may lie in the connection between disengagement and dropout (see Goldschmidt & Wang, 1999). A recent study found that many *high-achieving* students reported the perceived irrelevance of classes and resulting disengagement as their primary reason for dropping out (Bridgeland, DiIulio, & Morison, 2006). It appears as if school disengagement mechanisms affect CP and general-track students to similar degrees, irrespective of differences in educational resources. While disengagement effects were not explored here, results indicate that potential need to qualify blanket assumptions about the advantages of CP curricula for *all* students.

CTE

Perkins 1990 sought to improve educational outcomes for traditionally work-bound youth through career-oriented high school programs. Results from this study provide evidence for the positive effects of CTE on high school completion. Even though career-oriented programs are often more resource intensive, investments in CTE appear to generate substantive school completion returns. The widespread stigmatization of high school CTE as a dumping ground for unmotivated or incapable students should, therefore, be reconsidered.

The fact that general-track students obtained GEDs at significantly higher rates than their CTE counterparts is a mixed blessing. Obtaining a GED is a preferred outcome for high school dropouts because GED holders benefit from faster wage growth (Murnane, Willett, & Boudett, 1995) and exhibit a higher likelihood of enrolling in postsecondary education than non-GED dropouts (Garet, Jing, & Kutner, 1996). However, GED holders who enroll in postsecondary education are much less likely to *complete* their degree compared to those with a regular high school diploma (Cameron & Heckman, 1993). GED holders also achieve lower average rates of employment and income (Heckman, & LaFontaine, 2006). While obtaining a GED is beneficial, it is clearly less desirable than obtaining a regular high school diploma.

Given that Perkins 1990 sought to position CTE more clearly as a pathway to postsecondary education, the absence of any postsecondary attainment effects for this 1997 cohort of ninth-graders is quite sobering, especially at the two-year college level. As data for more cohorts become available, future research should continue to assess transition effects from high school CTE to postsecondary education.

Educational attainment effects of high school tracking were evaluated for a cohort of ninth graders from the NLSY97. Results support a growing body of literature (e.g., Kim & Bragg, 2008; Levesque et al., 2008; Plank et al., 2008) that considers CTE an effective option to increase high school completion rates as a critical precursor to postsecondary educational attainment.

References

Agodini, R., & Deke, J. (2004). *The relationship between high school vocational education and dropping out.* Princeton, NJ: Mathematica Policy Research.

Agodini, R., Uhl, S., & Novak, T. (2004). *Factors that influence participation in secondary vocational education.* Princeton, NJ: Mathematica Policy Research.

Arum, R., & Shavit, Y. (1995). Secondary vocational education and the transition from school to work. *Sociology of Education,* 68, 187-204.

Barton, P. E. (2005). *One-third of a nation: Rising dropout rates and declining opportunities.* Princeton, NJ: Educational Testing Service, Policy Information Center.

Barro, R. J. (2001). Human capital and growth. *American Economic Review,* 91, 12-17.

Berends, M. (1995). Educational stratification and students' social bonding to school. *British Journal of Sociology of Education,* 16, 327-351.

Bridgeland, J. M., DiIulio, J. J., & Morison, K. B. (2006). *The silent epidemic: Perspectives of high school dropouts.* Washington, DC: Civic Enterprises.

Cameron, S. V., & Heckman, J. J. (1993). The nonequivalence of high school equivalents. *Journal of Labor Economics,* 11, 1-47.

Castellano, M., Stringfield, S., & Stone III, J. R. (2003). Secondary career and technical education and comprehensive school reform: Implications for research and practice. *Review of Educational Research,* 73, 231-272.

Cellini, S. R. (2006). Smoothing the transition to college? The effect of Tech-Prep programs on educational attainment. *Economics of Education Review,* 25, 394-411.

Cohen, J. (1988). *Statistical power analysis for the behavioral sciences.* Hillsdale, NJ: Erlbaum.

Crissey, S. R. (2009). *Educational attainment in the United States: 2007.* Washington, DC: U.S. Census Bureau.

DeLuca, S., Plank, S., & Estacion, A. (2006). *Does career and technical education affect college enrollment?* St. Paul, MN: University of Minnesota.

Foster, J. C. (2007). Assessment as a tool to evaluate the benefits of CTE. *International Journal of Vocational Education and Training,* 15, 55-62.

Gamoran, A., & Mare, R. D. (1989). Secondary school tracking and educational inequality: Compensation, reinforcement, or neutrality? *American Journal of Sociology, 94,* 1146-1183.

Garet, M. S., Jing, Z., & Kutner, M. (1996). *The labor market effects of completing the GED: Asking the right questions.* Washington, DC: American Institutes for Research.

Goldschmidt, P., & Wang, J. (1999). When can schools affect dropout behavior: A longitudinal multilevel analysis. *American Educational Research Journal, 36,* 715-738.

Guo, S., & Fraser, M. W. (2010). *Propensity score analysis: Statistical methods and applications.* Thousand Oaks, CA: Sage.

Hallinan, M. T. (2003). Ability grouping and student learning. *Brookings Papers on Education Policy, 1,* 95-124.

Hanushek, E. A., Kain, J. F., Markman, J. M., & Rivkin, S. G. (2003). Does peer ability affect student achievement? *Journal of Applied Econometrics, 18,* 527-544.

Heckman, J. J., & LaFontaine, P. A. (2006). Bias corrected estimates of GED returns. *Journal of Labor Economics, 24,* 661-700.

Ho, D. E., Imai, K., King, G., & Stuart, E. A. (2007). Matchit (2.4-11) [computer software]. Retrieved from http://gking.harvard.edu/matchit

Ho, M. S., & Jorgenson, D. W. (1995). *The quality of the U.S. work force, 1948-95.* Cambridge, MA: Harvard University.

Horn, L., & Kojaku, L. K. (2001). *High school academic curriculum and the persistence path through college: Persistence and transfer behavior of undergraduates 3 years after entering 4-year institutions.* Washington, DC: U.S. Department of Education.

Jones, J. D., Vanfossen, B. E., & Ensminger, M. E. (1995). Individual and organizational predictors of high school track placement. *Sociology of Education, 68,* 287-300.

Kim, J., & Bragg, D. D. (2008). The impact of dual and articulated credit on college readiness and retention in four community colleges. *Career and Technical Education Research, 33,* 133-158.

Kodrzycki, Y. K. (2002, June). *Educational attainment as a constraint on economic growth and social progress.* Paper presented at the Federal Reserve Bank of Boston's 47th annual conference, Boston, MA.

Lee, V. E., & Ready, D. D. (2009). U.S. high school curriculum: Three phases of contemporary research and reform. *The Future of Children, 19,* 135-156.

Leuven, E., & Sianesi, B. (2003). Psmatch2: Stata module to perform full Mahalanobis and propensity score matching, common support graphing, and covariate imbalance testing. [computer software]. Boston, MA: Boston College.

Levesque, K., Laird, J., Hensley, E., Choy, S. P., Cataldi, E. F., & Hudson, L. (2008). *Career and technical education in the United States: 1990 to 2005* (NCES 2008-035). Washington, DC: U.S. Department of Education.

Lewis, T., & Cheng, S. (2006). Tracking, expectations, and the transformation of vocational education. *American Journal of Education, 113,* 67-99.

Linver, M. R., Davis-Kean, P., & Eccles, J. E. (2002, April). *Influences of gender on academic achievement.* Paper presented at the biennial meetings of the Society for Research on Adolescence, New Orleans, LA.

Little, R. J. (1988). A test of missing completely at random for multivariate data with missing values. *Journal of the American Statistical Association, 83,* 1198-1202.

Lucas, S. R., & Berends, M. (2002). Sociodemographic diversity, correlated achievement, and de facto tracking. *Sociology of Education, 75,* 328-348.

MacDonald, P. L., & Gardner, R. C. (2000). Type I error rate comparisons of post hoc procedures for I x J chi-square tables. *Educational and Psychological Measurement, 60,* 735-754.

Marsh, R. S., & Raywid, M. A. (1994). How to make detracking work. *Phi Delta Kappan, 76,* 314-317.

Murnane, R. J., Willett, J. B., & Boudett, K. P. (1995). Do high school dropouts benefit from obtaining a GED? *Educational Evaluation and Policy Analysis, 17,* 133-147.

National Center on Education and the Economy. (1990). *America's choice: High skills or low wages! The report of the commission on the skills of the American workforce.* Rochester, NY: Author.

National Center on Education and the Economy. (2007). *Tough choices or tough times: The report of the new commission on the skills of the American workforce.* San Francisco, CA: Jossey-Bass.

National Commission on Excellence in Education. (1983). *A nation at risk: The imperative for reform.* Retrieved from http://www.ed.gov/pubs/NatAtRisk/risk.html

Natriello, G., Pallas, A. M., & Alexander, K. (1989). On the right track? Curriculum and academic achievement. *Sociology of Education, 62,* 109-118.

Neumark, D., & Rothstein, D. (2006). School-to-career programs and transitions to employment and higher education. *Economics of Education Review,* 25, 374-393.

Organization for Economic Cooperation and Development. (2009). *Education at a glance 2009.* Paris, France: Author.

Pittman, R. B. (1991). Social factors, enrollment in vocational/technical courses, and high school dropout rates. *Journal of Educational Research, 84,* 288-295.

Plank, S. B., DeLuca, S., & Estacion, A. (2008). High school dropout and the role of career and technical education: A survival analysis of surviving high school. *Sociology of Education, 81,* 345-370.

Rasinski, K. A., & Pedlow, S. (1994). Using transcripts to study the effectiveness of vocational education. *Journal of Vocational Education Research, 19,* 23-44.

Rosenbaum, P. R. (2002). *Observational studies.* New York, NY: Springer.

Rosenbaum, P. R., & Rubin, D. B. (1983). The central role of the propensity score in observational studies for causal effects. *Biometrika, 70,* 41-55.

Rosenbaum, P. R., & Rubin, D. B. (1984). Reducing bias in observational studies using subclassification on the propensity score. *Journal of the American Statistical Association, 79,* 516-523.

Rosenbaum, P. R., & Rubin, D. B. (1985). Constructing a control group using multivariate matched sampling methods that incorporate the propensity score. *The American Statistician, 39,* 33-38.

Rubin, D. B. (1987). *Multiple imputation for nonresponse in surveys.* New York, NY: Wiley.

Schafer, J. L. (1997). *Analysis of incomplete multivariate data.* Boca Raton, FL: Chapman & Hall.

Schafer, J. L., & Graham, J. W. (2002). Missing data: Our view of the state of the art. *Psychological Methods, 7,* 147-177.

Sidak, Z. (1967). Rectangular confidence regions for the means of multivariate normal distributions. *Journal of the American Statistical Association, 62,* 626-633.

Silverberg, M., Warner, E., Fong, M., & Goodwin, D. (2004). *National assessment of vocational education: Final report to Congress.* Washington, DC: U.S. Department of Education.

Sirin, S. R. (2005). Socioeconomic status and academic achievement: A meta-analytic review of research. *Review of Educational Research, 75,* 417-453.

Snyder, T. D., Dillow, S. A., & Hoffman, C. M. (2009). *Digest of education statistics 2008* (NCES 2009-020). Washington, DC: U.S. Department of Education.

Stone, J. R., & Aliaga, O. A. (2005). Career and technical education and school-to-work at the end of the 20th century: Participation and outcomes. *Career and Technical Education Research, 30,* 125-144.

Swanson, C. B. (2009). *Closing the graduation gap: Educational and economic conditions in America's largest cities.* Bethesda, MD: Educational Projects in Education Research Center.

U.S. Department of Education. (2008). *A nation accountable: Twenty-five years after a nation at risk.* Washington, DC: Author.

Van Buuren, S., & Groothuis-Oudshoorn, K. (2009). MICE: Multivariate imputation by chained equations in R. Journal of Statistical Software, retrieved from http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.169.5745&rep=rep1&type=pdf

Appendix A: Pooled Pre-matching Covariate Balance

Pooled Covariate Differences Between CTE and General-track Students (Pre-matching)

Variable	*CTE*[a]		*General-track*[b]					
	M	*S.E.*	*M*	*S.E.*	*t*	*df*	χ^2	*d*[c]
Survey weight	228064.87	5098.743	203063.32	4086.552	-3.764***	720		.29
Gender	1.37	.030	1.51	.023		1	12.576***	-.28
Race/ethnicity (dummy 1)	.22	.026	.32	.022		1	7.901**	-.23
Race/ethnicity (dummy 2)	.16	.023	.22	.019		1	3.453	-.15
Urbanicity	.71	.028	.72	.021		1	.128	-.02
Household poverty ratio (square root)	15.29	.352	14.45	.301	-1.761	720		.14
Grades received in eighth grade	5.15	.102	5.26	.075	.959	720		-.07
PIAT math standard score	92.82	.810	91.39	.670	-1.314	720		.10
Work-based learning	.18	.024	.16	.017		1	.272	.04
Remedial English and/or math	.17	.023	.19	.018		1	.409	-.05
ESL and/or bilingual program	.07	.016	.11	.015		1	2.527	-.14
Educational and/or physical handicap	.09	.018	.06	.011		1	1.842	.11
Attitudes toward school	15.88	.166	16.45	.135	2.613**	720		-.20
Number of days absent from school	4.10	.275	6.18	.401	3.641***	720		-.30
Ever suspended from school	.30	.028	.40	.023		1	8.184***	-.21
School type	1.03	.011	1.06	.011		1	1.779	-.14
Student-teacher ratio	2.22	.066	2.40	.050	2.113*	720		-.17
Percent peers college-bound	3.44	.058	3.37	.049	-.910	720		.07

[a] $n = 262$ [b] $n = 460$ [c] $d = M_t - M_c / \sigma_{pooled}$; *where* $\sigma_{pooled} = \sqrt{\sigma^2_t + \sigma^2_c / 2}$ $^{*}p < .05$ $^{**}p < .01$ $^{***}p < .001$

Pooled Covariate Differences Between CP and General-track Students (Pre-matching)

Variable	*CP*[a]		*General-track*[b]					
	M	*S.E.*	*M*	*S.E.*	*t*	*df*	χ^2	*d*[c]
Survey weight	238530.25	5606.723	203063.32	4086.552	-4.937***	662		.42
Gender	1.64	.034	1.51	.023		1	9.847**	.26
Race/ethnicity (dummy 1)	.17	.026	.32	.022		1	14.758***	-.35
Race/ethnicity (dummy 2)	.15	.025	.22	.019		1	4.949*	-.18
Urbanicity	.77	.029	.72	.021		1	1.927	.12
Household poverty ratio (square root)	18.51	.458	14.45	.301	-7.468***	662		.63
Grades received in eighth grade	6.91	.080	5.26	.075	-13.173***	662		1.18
PIAT math standard score	105.11	1.007	91.39	.670	-11.303***	662		.95
Work-based learning	.10	.021	.16	.017		1	4.895*	-.19
Remedial English and/or math	.06	.017	.19	.018		1	16.917***	-.40
ESL and/or bilingual program	.08	.019	.11	.015		1	1.446	-.10
Educational and/or physical handicap	.01	.008	.06	.011		1	6.767**	-.26
Attitudes toward school	15.00	.204	16.45	.135	5.941***	662		-.50
Number of days absent from school	2.78	.250	6.18	.401	5.484***	662		-.53
Ever suspended from school	.07	.018	.40	.023		1	73.275***	-.84
School type	1.16	.026	1.06	.011		1	17.849***	.33
Student-teacher ratio	2.40	.073	2.40	.050	-.046	662		.01
Percent peers college-bound	3.78	.063	3.37	.049	-4.845***	662		.42

[a] $n = 204$ [b] $n = 460$ [c] $d = M_t - M_c / \sigma_{pooled}$; *where* $\sigma_{pooled} = \sqrt{\sigma^2_t + \sigma^2_c / 2}$ $^{*}p < .05$ $^{**}p < .01$ $^{***}p < .001$

Appendix B: Pooled Post-matching Covariate Balance

(Note: Due to space limitations, results are displayed for 5:1 Nearest-neighbor matching only. Results for Full matching are similar and available upon request)

Pooled Covariate Differences Between CTE and General-track Students After 5:1 Nearest-neighbor Matching

Variable	*CTE*[a]		*General-track*[b]					
	M	*S.E.*	*M*	*S.E.*	*t*	*df*	χ^2	*d*[c]
Survey weight	226890.17	5197.992	222756.43	4760.720	-.605	631		.05
Gender	1.38	.031	1.40	.026		1	.131	-.03
Race/ethnicity (dummy 1)	.22	.026	.23	.024		1	.117	-.02
Race/ethnicity (dummy 2)	.17	.023	.18	.020		1	.154	-.03
Urbanicity	.71	.028	.72	.023		1	.225	-.02
Household poverty ratio (square root)	15.31	.366	15.26	.358	-.122	631		.01
Grades received in eighth grade	5.15	.103	5.13	.118	-.142	631		.01
PIAT math standard score	92.55	.875	92.47	.888	-.064	631		.00
Work-based learning	.18	.024	.18	.020		1	.097	-.02
Remedial English and/or math	.17	.024	.17	.019		1	.030	.01
ESL and/or bilingual program	.07	.016	.08	.016		1	.101	-.01
Educational and/or physical handicap	.09	.017	.08	.018		1	.224	.02
Attitudes toward school	15.94	.168	15.84	.154	-.423	631		.04
Number of days absent from school	4.17	.283	3.96	.252	-.616	631		.05
Ever suspended from school	.30	.029	.30	.031		1	.287	.01
School type	1.04	.011	1.03	.011		1	.033	.02
Student-teacher ratio	2.24	.067	2.26	.066	.146	631		-.01
Percent peers college-bound	3.43	.059	3.44	.060	.120	631		-.01

[a] $n = 256$ [b] $n = 377$ [c] $d = M_t - M_c / \sigma_{pooled}$; *where* $\sigma_{pooled} = \sqrt{\sigma^2_{t+} \sigma^2_c} / 2$ $^{*}p < .05$ $^{**}p < .01$ $^{***}p < .001$ Pooled *n* and *df* were rounded to the nearest integer.

Pooled Covariate Differences Between CP and General-track Students After 5:1 Nearest-neighbor Matching

Variable	*CP*[a]		*General-track*[b]					
	M	*S.E.*	*M*	*S.E.*	*t*	*df*	χ^2	*d*[c]
Survey weight	238299.00	5718.375	237919.03	6277.526	-.044	421		.00
Gender	1.66	.034	1.65	.040		1	.255	.01
Race/ethnicity (dummy 1)	.18	.027	.17	.029		1	.103	.01
Race/ethnicity (dummy 2)	.15	.025	.13	.025		1	.172	.04
Urbanicity	.78	.030	.76	.029		1	.371	.05
Household poverty ratio (square root)	18.44	.487	18.24	.681	-.308	421		.03
Grades received in eighth grade	6.89	.086	6.97	.084	.701	421		-.07
PIAT math standard score	104.26	.980	103.87	1.102	-.305	421		.03
Work-based learning	.10	.022	.11	.025		1	.192	-.01
Remedial English and/or math	.07	.018	.05	.016		1	.599	.08
ESL and/or bilingual program	.08	.020	.08	.020		1	.036	-.02
Educational and/or physical handicap	.02	.009	.01	.007		1	.221	.09
Attitudes toward school	15.04	.208	15.07	.202	.107	421		-.01
Number of days absent from school	2.78	.239	2.56	.205	-.763	421		.07
Ever suspended from school	.08	.019	.07	.018		1	.118	.04
School type	1.16	.026	1.15	.032		1	.384	.02
Student-teacher ratio	2.40	.076	2.45	.087	.497	421		-.05
Percent peers college-bound	3.77	.064	3.78	.083	.106	421		-.01

[a] $n = 198$ [b] $n = 225$ [c] $d = M_t - M_c / \sigma_{pooled}$; *where* $\sigma_{pooled} = \sqrt{\sigma^2_{t+} \sigma^2_c} / 2$ $^{*}p < .05$ $^{**}p < .01$ $^{***}p < .001$ Pooled *n* and *df* were rounded to the nearest integer.

Strengthening Career and Technical Education in the California Community College System: An Implication for Workforce Development in the 21st Century

Renah Wolzinger
Golden West Community College, USA
Henry O'Lawrence
California State University, Long Beach, USA

Abstract

This study investigated the different Career and Technical Education (CTE) programs offered in California community colleges. Data from all CTE programs in five colleges were analyzed and the top 17 programs were chosen for their significantly higher number of enrolled students during the past three years. Only programs that were identified as vocational by the California Community College Chancellor's Office were included in the study. The overall purpose of this study was to identify the core strengths of CTE programs that provide preparation for a state licensure exam. The results were used to develop a profile of strong CTE programs and to recommend ways of strengthening CTE program offerings in a single college environment.
Keywords: California Community Colleges, CTE vocational programs, Certification, CTE skills model, workforce.

Introduction

California has the largest community college system in the country, with 72 districts, 110 colleges, and more than 2.9 million students. There are more than 270 occupational programs, leading to certificates or licenses based on industry standards (California Department of Education, 2008). The colleges range in size from small to large, from 1,500 students to 36,000 students, with one college in Northern California being one of the largest in the country, with more than 100,000 students.

California community colleges offer more than 175 degree and certificate programs. The certificate system is designed to provide workforce skills in

certain areas, with the opportunity to obtain additional certificates leading to advanced job skills or advancement in employment. There are many exit points in Career and Technical Education (CTE) programs, where students either enter the workforce or continue their education. Some CTE programs also may be combined with general education to obtain an Associate's degree, and prepare a student to transfer to a 4-year university program (California Department of Education, 2008).

The field of Career and technical programs has evolved into a broader definition of workforce preparedness education, which is critical in today's high-tech work environment (Rojewski, 2002). The dynamic and increasingly global nature of work and the workforce, the evolving patterns of family and community living, and the need for career and technical educators to revise and update curricular contents so that constituent groups are adequately prepared to meet the emerging challenges encountered in the work place, family, and community have always been major issues that have substantially impacted CTE.

Currently, there is policy and financial support at the state and national level to increase STEM (Science, Technology, Engineering and Math) education in secondary and postsecondary institutions. The current national focus on increasing STEM education is an opportunity to demonstrate to students how disciplinary content areas, such as algebra or physics, can be applied to real-world situations and problem solving (Brand, 2008).

Educators and employees in California agree that the CTE system must focus on preparing students for higher order-skill, high-wage, and high-demand occupations (California Department of Education, 2008). Fifteen sectors have been identified and two to seven career pathways have been identified within each sector. The CTE sectors for California as identified by the California Department of Education are:

1. Agriculture and Natural Resources
2. Arts, Media, and Entertainment
3. Building Trades and Construction
4. Education, Child Development, and Family Services
5. Energy and Utilities
6. Engineering and Design
7. Fashion and Interior Design
8. Finance and Business
9. Health Science and Medical Technology
10. Hospitality, Tourism, and Recreation
11. Information Technology
12. Manufacturing and Product Development
13. Marketing, Sales, and Service

14. Public Services
15. Transportation

In 2007, the California Community College Chancellor's Office developed ten committees to study the relevance of curriculum, responsiveness to industry, funding priorities, emerging industries, industry partnerships, and program development needs. The goal of these committees is to improve CTE education in the ten identified areas, which are: 1) Agriculture and Natural Resources, 2) Business Education, 3) Family and Consumer Sciences, 4) Health Careers, 5) Industrial and Technical, 6) Public Safety Education, 7) Career Development, 8) Research and Accountability, 9) Special Populations, and 10) Work-Based Learning and Employment Services.

The 2008–2012 California State Plans for CTE is designed to advance California's economic growth and global competitiveness through improved education including increased use of technology, continuous workforce development, and analysis of workforce needs and trends. All new programs are required to be submitted to the district and state for approval, based on labor market needs. New and emerging areas are sent to the California Postsecondary Education Commission for approval. The California Employment Development Department has listed the following industries as most critical for the California economy: automotive, biotechnology, construction, energy, financial services, aerospace, health care, hospitality, information technology, manufacturing, retail, transportation, agriculture, arts, media, and entertainment (California Department of Education, 2008).

In order to measure the strength of a CTE program, California has developed guiding principles for CTE planning and implementation. CTE is accountable by means of measuring and reporting student course participation, completion of CTE courses and pathways, student and program certification, transition to postsecondary education, completion of postsecondary certificates and degree programs, short-term and long-term employment outcomes, and other measures necessary to ensure program quality (California Department of Education, 2008).

The state also has identified 15 elements of a high-quality CTE system. These characteristics are: leadership at all levels, high-quality curriculum and instruction, career exploration and guidance, student support and student leadership development, industry partnerships, system alignment and coherence, effective organizational design, system responsiveness to changing economic demands, skilled faculty and professional development, evaluation, accountability, and continuous improvement, CTE promotion, outreach, and communication (California Department of Education, 2009). The above elements are also aligned in the Perkins IV legislation to determine funding levels

for CTE programs, as well as in the defined career pathways for California students. The Perkins Act has been a critical component in funding college programs related to Career and Technical Education.

In an analysis completed by the U.S. Department of Education, the persistence and completion of occupational students entering 2-year institutions were reported. Students entering college seeking a credential had a 60% completion rate nationally. This rate is lower than for baccalaureate students, who have an 82% completion rate. There were no statistical differences between students seeking an occupational certificate or an associate degree. Students who completed an occupational program had a better chance of employment in their field than those who did not complete their program. The highest success rate in employment related to field of study was 74.5% for students who completed an occupational program and achieved an associate degree. The lowest rate of success was 42.6% for occupational students who did not complete the associate degree requirements (U.S. Department of Labor, 2008).

Problem Statement and Purpose of the Study

As labor market trends shift and financial support policies for CTE programs change over time, it is inevitable that certain CTE programs require updating, merging, or even elimination in order to fit into the current needs of the college, the students, and the community. CTE programs are one of the major tools that the federal and state governments are relying on to impact positively the unemployment situation in America. Many jobs that workers were trained for no longer exist and therefore job retraining has become a priority to bring people back into the workplace.

The purpose of this study was to verify the profile for strong core CTE programs that strengthen and provide preparation for a state licensure exam as defined by the California Department of Education (2008). This will show whether the profile continues to produce higher success rates for students. Identifying strengths and weaknesses in these programs would aid the strengthening of CTE program offerings in a single college environment. This study also examined several CTE programs in Southern California, targeting representative California community colleges in order to develop a model of strong CTE offerings at an individual institution. Program statistics relating to characteristics of a strong CTE program were collected and analyzed.

Significance of the Study

California community colleges have a large number of CTE programs that have been in place since the 1960s. However, the broad spectrum of CTE offerings is not sustainable in the current funding environment. The programs in the community college system that prepare students for state license exams

are among those that have historically been the most successful. This study examined several traits of strong programs under the CTE umbrella that prepare students for a state license examination. These programs are a foundation of a strong CTE division. This study will show that strengthening CTE in the California community college system during the current financial and labor market crisis can be accomplished by supporting and expanding programs, for which employment prospects is dependent on government or professional certification, and reducing programs in those areas that do not require certification for employment.

Methodology and Data Collection

This study employed quantitative research methods to explore the degree of learning and transfer of learning achieved by community college students in Southern California. Quantitative research using a secondary quantitative data review approach was chosen to achieve the following two objectives:

1. Understand observed changes in graduates following completion of CTE program.
2. Explore fully the factors affecting student enrollment and program completion.

Data used from this report include credits, degrees, and certificate awarded statewide by program, and ratings of the top vocational programs in the state. Data are also provided on individual colleges on achievement and persistence rates of students.

The National Center for Education Statistics was also used to collect data. Data used from NCES include program completion by community college, including one-year certificates, one to two-year certificates and associate's degree awards.

The Bureau of Labor Statistics was also used to collect data regarding occupational outlook for jobs by job type, salary, and expected employment growth. The main data source is the California Community College Chancellor's Office, which is the direct reporting agency for educational data from all California community colleges.

Data was combined by year for each program by college, and sorted for highest success rates as defined by successful course completion and achievement of a certificate or degree awarded by the college. Data was analyzed over a five year period from the California Chancellor's public data.

Population and Study Sample

The population for this study includes students enrolled in postsecondary technical education programs in community colleges in California. The study

sample used was CTE students in five community colleges in Southern California. These colleges were chosen as a model because the structure, size, demographics, and program offerings were similar and represent a wide range of CTE programs available in the California community college system.

Enrollment data was obtained by also using courses that were identified as having Vocational Education Status. Data pertaining to certificates and degrees awarded were cross-referenced to the same data provided by the Nation Center for Education Statistics to insure accuracy by college and program. Data collected were statistically analyzed on a computer using Microsoft Excel and SPSS software. The data was sorted into tables by academic year to evaluate trends in the last three academic years, and then analyzed to evaluate program trends in enrollment; awards obtained, and program success defined by successful course completion, and certificate or AA completion.

Independent and Dependent Variables

The major independent variables in this study were students seeking postsecondary technical degrees and certificates from community colleges institutions in California. The students were identified by Full-Time Equivalent Student (FTES) data for vocational programs in each college. The dependent variables identified in this study included three major areas: (a) the enrollment of students in each program using FTESs by semester, TOP code (Taxonomy of Programs for the State of California), and Vocational Education Status; (b) success rates by college and program (Number of enrollments with grade of A, B, C, CR, P); and (c) student program awards (AA/AS awards, Certificates of Achievement 30-60 credits and 18-30 credits, Certificates of Specialization 6-18 credits). Table 1 demonstrates enrollments in all programs of CTE in Southern California for the past 3 years. The table also shows programs that are in higher demand with their FTES, awards, and success rates. This table represents the overall growth in programs that prepare students for state or professional license exams over programs that do not require a license in order to obtain employment.

Table 1
Major CTE Programs, FTES, Awards, and Success Rates in All Sample Schools Combined

Year	Program	FTES	Awards	Success Rate %
2008-2009	Accounting	1610.79	135.00	68.90
	Admin of Justice	451.87	214.00	79.00
	Appl Photo	406.52	25.00	67.25
	Architecture	373.64	68.00	77.33
	Auto Tech	440.71	172.00	74.67
	Child Dev	669.81	73.00	77.00
	Comp Inf Sys	732.26	18.00	64.63
	Comp Software	748.06	28.00	60.30
	Cosmetology	779.11	132.00	79.75
	Dig Media	621.11	50.00	63.80
	Film Studies	427.55	39.00	74.50
	Graph Art/Des	245.81	30.00	70.80
	Nursing	1154.3	615.00	88.17
	Nutrition	521.28	151.00	75.00
	Office Tec/Comp	449.21	31.00	55.88
	Radiology Tec	315.73	75.00	91.00
	Radio/TV	293.67	13.00	75.33
2007-2008	Accounting	1528.34	96	67.03
	Admin of Justice	535.27	177	78.85
	Appl Photo	492.49	21	58.75
	Architecture	350.54	72	75.85
	Auto Tech	483.64	314	74.98
	Child Dev	527.34	75	76.78
	Comp Inf Sys	282.75	6	67.02
	Comp Software	389.65	25	61.01
	Cosmetology	809	166	88.80
	Dig Media	110.48	38	92.32
	Film Studies	115.22	22	66.75
	Graph Art/Des	196.26	26	70.73
	Nursing	542.91	575	87.71
	Nutrition	254.31	192	72.34
	Office Tec/Comp	416.5	21	55.77
	Radiology Tec	376.48	74	89.31
	Radio/TV	256.12	9	75.40
2006-2007	Accounting	1417.89	87	68.89
	Admin of Justice	214.27	212	79.46
	Appl Photo	500.28	8	57.62
	Architecture	351.81	31	75.93
	Auto Tech	356.81	138	77.59
	Child Dev	467.75	57	77.41
	Comp Inf Sys	286.41	15	67.59
	Comp Software	321.26	32	62.51
	Cosmetology	716.18	48	93.01
	Dig Media	120.73	32	63.32
	Film Studies	119.81	15	72.28

Note: This data was compiled from the Chancellor's Office Data Mart in the California Community Colleges Chancellor's Office

Findings and Conclusion

To answer the first question regarding strengthening CTE in the California community college system, data were compiled looking at the top 17 programs in community colleges in Southern California. Small programs at a single college, or the FTES and awards for the years studied were smaller than the 17 programs that not included for this study. Future studies could analyze smaller programs, or programs that are more prevalent in different California regions. Data included enrollment numbers by FTES and program awards. Awards included: Associate degrees, Certificates of Achievement, and Certificates of Specialization.

Success rates were also evaluated to show whether the difficulty of courses in a program impacted program completion. There were several programs with high enrollment that also had a high number of awards, denoting that students successfully completed the program. The first group of programs evaluated by FTES and awards are: Accounting, Administration of Justice, Automotive Technician, Cosmetology, Nursing, and Nutrition.

In addition, these six programs grew each year in enrollment and awards between the years 2006 and 2009. The FTES for these programs (colleges combined) ranged from 440 to 1610, and the awards given were between 132-615 for the academic year 2008–2009. The second group of programs evaluated by FTES and awards are: Architecture, Child Development, Digital Media, Film Studies, and Radiology Technician. These five programs did not grow at the same rate as the previous group; however, Digital Media and Film Studies grew significantly in enrollment. The FTES for these programs (colleges combined) ranged from 315 to 669, and the awards given were between 39 -75 for the academic year 2008–2009. Of these programs, Child Development and Digital. The third group of programs evaluated by FTES and awards are: Applied Photography, Computer Information Systems, Computer Software Development, Graphic Art and Design, Office Technology/Office Computer Applications, and Radio and Television.

From these six programs, the Computer Information Systems and Computer Software Development had tremendous growth in FTES; however, they had smaller number of awards than the previous groups. The FTES for the programs (colleges combined) were 245–748, and for the academic year 2008–2009 between 13-31awards were given. Success rates were highest for Radiology Technician, Nursing, and Administration of Justice (69%–91% success rate). These programs fell in Groups 1 and 2 for this study. Success rates were lowest for Office Technology/Office Computer Applications, Computer Software Development, Computer Information Systems, and Digital Media (56%–65%). These programs fell in Groups 2 and 3 for this study.

In order to strengthen CTE program offerings at a single campus, the goal would be to provide programs that lead to higher matched employment rates. Group 1 programs satisfy all of these requirements. Each of the programs in Group 1 (Accounting, Administration of Justice, Automotive Technician, Cosmetology, Nursing, and Nutrition) has a strong demand in the workplace (Table 2). Each of these programs prepares students for a state license or professional exam, which is required for employment in these areas. Group 1 completion rates may be correlated to programs that prepare students for their license or professional exams.

Table 2
Fasted Growing Occupations with Most Opening in California

Occupation Title	Average Annual Job Openings
Registered Nurses	9,900
Elementary School Teachers	9,320
Executive Secretaries	7,400
Bookkeeping & Accounting	7,140
General and Operations Managers	6,630
Accountants and Auditors	5,820
Secondary School Teachers	5,700
Child Care Workers	5,470
Computer Software Engineers	5,380
Managers of Office and Admin Support	5,160
Computer Systems Analysts	2,950
Lawyers	2,900
Police and Sheriff Patrol Officers	2,730
Automotive Technicians and Mechanics	2,700
Middle School Teachers	2,600
Licensed Practical and Vocational Nurses	2,580
Medical Assistants	2,570
Electricians	2,460
Computer Software Eng/Systems Software	2,230
Preschool Teachers	1,990
Network & Computer Systems Administrators	1,720
Correctional Officers	1,660
Cosmetologists	1,580
Multi-Media Artists and Animators	1,540
Graphic Designers	1,490

Note: Compiled from EDD Top 100 Jobs with the Most Openings in California (2006–2016)

Programs that were selected for Group 2 (Architecture, Child Development, Digital Media, Film Studies, and Radiology Technician) are already strong but have the potential to grow more. These programs are growing year to year, but could have a higher number of awards given. In addition, programs that are

related could be combined to create a new environment of shared facilities, resources, and technology. Programs lacking a state licensure or professional license component could combine with programs that have that element in order to help them grow in FTES and program completion.

Programs that were selected for Group 3 (Applied Photography, Computer Information Systems, Computer Software Development, Graphic Art and Design, Office Technology/Office Computer Applications, and Radio and Television) had a good enrollment and steady growth; however, they had a relatively low number of awards compared to Group 1 and Group 2. These fields have a retraining element in common. Some students from industry attend these programs to get up to date on computer software and equipment used in the workplace. In fields involving cameras, video, or audio, the change from analog formats to digital and high-definition formats has altered dramatically those areas in the past three years. Software has changed to accommodate those new digital technologies. Another component of these programs is that they do not lead to state license exams, but could lead to professional exams. For example, software certification in Adobe, Avid, or Final Cut software could be incorporated into some of these programs.

In order to strengthen CTE offerings at a single college environment, it may also be possible to combine programs to make them stronger. Using the programs from this study, the recommendations follow.

Stand Alone Programs

The Accounting, Criminal Justice, Architecture, Automotive Technician, Child Development, Cosmetology, Nursing, Nutrition, and Radiology Technician programs are unique and strong, and prepare students for a state or professional license exam. It would not be necessary to combine these programs with other programs. Combining programs might only be effective when there are many similarities and where the workplace requires a worker to have multiple skills for one job. These programs do not fit into that category. However in the case of Radiology Technician, it may be advantageous for one campus that offers other smaller Medical Technology certificates to share resources and combine with the Radiology Technician program.

Programs that can be strengthened by combining with strong programs are: (a) Applied Photography, Digital Media, Film Studies, Graphic Art/Design, Radio/TV; (b) Computer Information Systems, Computer Software, Office Technology/Office Computer Applications. These programs are broken into two groups, as they could share resources in these groups or could combine to be one large group. Group A may have different computer requirements than Group B.

The second research question was: Can a model be developed based on

strong CTE programs to aid in the reformulation of current CTE offerings in California community colleges? To answer this question, it is important to examine what qualities make a program strong in enrollment, completion, and student success. According to the data, one single attribute that all of the strong programs have in common is that they prepare students for a state or professional license exam.

Recent studies show that CTE programs in California are a vital contributor to the workforce. The Research and Planning Group (RPG) (RPG, 2009) for California community colleges states that California will suffer major shortages of available workers with bachelor's degrees in the next decade unless there is an increase in available workers, especially from CTE disciplines. This study suggests increasing the transfer rate of CTE students from community colleges to four-year institutions. RPG also states that the workforce shortages are forecasted to be in STEM disciplines.

The Employment Development Department in California has reported the Orange County industry projections from 2006–2009. Half of all new jobs in California are projected to be in the following sectors: Professional and business services, leisure and hospitality, education, health care, and social assistance. The fastest growing industry sectors are projected to be education, health care and social assistance. The top 100 jobs with the most openings in California are listed by the Employment Development Department. Occupations related to this study are listed in Table 2.

References

Brand, B. (2008). *Technical education through federal and state policy.* American Youth Policy Forum.

California Department of Education. (2008). *2008-2012 California state plan for career and technical education.* Retrieved from http://www.schoolsmovingup.net/cte/downloads/cteplan_122808.pdf

California Department of Education (2009). California Community Colleges System Office, Sacramento, CA. ARCC 2008 Report.

Gray, K.C., & Herr, E. L. (1998). *Workforce education: The basics*. Boston, MA: Allyn and Bacon.

The Research and Planning Group for California Community Colleges (2009). *CTE transfer research project*. Retrieved from http://www.rpgroup.org/documents/CTEPhase ISummary.pdf

Rojewski, J. (2002). *Preparing the workforce of tomorrow: Conceptual framework for career and technical education.* Department of Occupational Studies, University of Georgia. Retrieved from http://136.165.122.102/mambo/index.php?option=com_content&task=view&id=168

U.S. Department of Labor. (2008, May). *The employment situation*. . Bureau of Labor Statistics. Retrieved from http://www.bls.gov/ces/

U.S. Department of Labor. (2006). *America's dynamic workforce 2006*. Retrieved from www.dol.gov.

Twenty-first Century Skills: Contemporary Instructional Strategies and Approaches for Technology Education

Joe R. Busby
North Carolina State University
Jeremy V. Ernst
Virginia Tech
Aaron C. Clark
North Carolina State University

Abstract

Technology education is experiencing change because of the progression of information being addressed and the instructional methods employed in secondary and post-secondary levels. Computational modeling, the focus of this transcript, is one contemporary technology that allows students to acquire 21st century skills and can be taught in Technology and Engineering Education classrooms. Expert thinking and complex communications are central to computational modeling. True science, technology, engineering and mathematics (STEM) integration can occur through the study of visualization and the development of both virtual and physical models. These new skills are sought after by business and industry, are transferable across communities and cultures, and promote continued education. Implementing computational technology in classrooms is possible because the technology required is now intuitive and cost effective.
Keywords: At-risk, computational, curriculum, dropout prevention, education, gaming, modelling, technical, technology, visualization.

Introduction

The beginning of the manual arts movement in the United States in the late 1800s with the influence of the Runkle School and the Swedish Sloyd system for technical instruction, to the international influence of the Jackson Mills Project in the 1980s, change and the ability to refocus curricula has been central to the identity of the technology and engineering education profession. Students and society benefit from modernized Technology Education because

of the professions ability and willingness to identify and anticipate necessary change. This ability to identify areas of change allows the profession to innovate curricula content and remain contemporary and state-of-the-art. Continual and ongoing curricular innovation and improvement is vital to the progressive nature of Technology Education. Not only does curricular innovation permit contemporary approaches, but it also allows for the infusion of emerging knowledge and skillsets that are marketable in the 21st Century workforce throughout the world.

Throughout the history of Technology Education the use of tools has been important for fulfilling the nature of the hands-on curriculum and generating artifacts (Pannabecker, 1995). Be it for the purpose of skill development or for developing conceptual knowledge, tools utilized in classrooms reflect the ability of the teacher, program, and/or school to acquire technologies for use. A lag in the availability of current technologies in schools stems from funding and familiarity. Regardless of the availability of the most current technologies globally, educational leaders need to be aware that these technologies have become the basic, the driver of pedagogical strategies and approaches for the improvement of educational quality.

Defining Expert thinking and Complex Communication

Skillsets prove to be important for students as they prepare for employment in a highly competitive, global job market. Expert thinking and complex communication are part of necessary 21st century skills as related to technology, engineering and design education. Murane and Levy (2004) indicated expert thinking and complex communication need to appear in curricula at all levels as well as in many different disciplines related to science, technology, engineering and mathematics (STEM) in order for a country to stay globally competitive. Expert thinking includes the need for critical thinking skills and creativity, addressing the abilities required to solve problems outside traditional frameworks. Complex communication addresses students' ability to break down information and communicate it in a variety of forms to diverse audiences. Both can easily be taught in the psychomotor-based technology, engineering and design education curriculum that capitalizes on exploration and creativity to complete virtual and physical projects/activities. Expert thinking and complex communication both rely on the student's ability to be visually literate and understand the role visualizations play in engineering and design, as well as how to harness the power of visualization to understand, analyze, create accurate messages, and communicate to many different types of audiences.

Expert thinking and complex communications are also to be considered as strategies for teaching and curriculum development (Clark & Ernst, 2010).

Both concepts lead students to develop higher thinking abilities indicated in the Revised Bloom's Taxonomy (Anderson & Krathwohl, 2001) and are useful in achieving the Standards for Technical Literacy (ITEA, 2007). More curricula is needed to support the concepts of expert thinking and complex communications in order to promote higher level thinking skills, provide avenues for technological literacy, and develop skills that are globally transferable.

Structure and Support for CTE

President George W. Bush reauthorized the Carl D. Perkins Act on August 12, 2006. The reauthorization specified an increased focus on academic achievement of Career and Technical Education (CTE) students, a mathematical design-oriented focus, problem-solving skill acquisition initiatives, and specific skill development initiatives among others. Many existing norms for CTE programs were kept in the act and include the presentation of information in a real-world context, enhancing 21st Century Skills, and improving state and local accountability. Resources for CTE programs were provided to develop and improve curricula, purchase equipment, and provide professional development and technical assistance for practicing CTE teachers (ACTE, 2008).

Career Clusters provide scaffolding for CTE from the national level. Sixteen Career Clusters provide a framework for addressing the entire world of work, spanning the eight program areas of CTE, and promoting career awareness, as many jobs now require knowledge and skills from multiple specialized areas. Career clusters help students identify and provide pathways toward career goals while insuring student success as they transition through high school, through technical training, and/or into the workplace.

In general, CTE is organized into eight program areas: 1) Agriculture Education, 2) Business Education, 3) Family and Consumer Science Education, 4) Health Occupations Education, 5) Marketing Education, 6) Technical Education, 7) Technology Education, and 8) Trade and Industrial Education (Scott & Sarkees-Wircenski, 2001). For example, the Public Schools of North Carolina maintains the *North Carolina Standard Course of Study* (NCSCOS) (NCDPI, 2008) to provide equal access for all students to the same basic curriculum. CTE is included in the NCSCOS with each designated program area having a scope and supporting sequence of courses. Technology Education is a CTE program area and through its scope and sequence, provides students with applications based content that assists in the development and enhancement of problem-solving, decision-making, and creative-thinking skills. Central components of the scope and sequence are inventive thinking that requires creativity and higher-order thinking, digital-age literacy through basic technological literacy, effective communication through teaming and collaboration, and

productivity through the use of real-world tools. The content and activities build upon academic concepts in a meaningful and relevant way through the integration and application of science, technology, engineering, and mathematics. This provides specific skills for the Science, Technology, Engineering and Mathematics Career Cluster.

Strategies for the Technology Education program include alignment with the national technology (ITEA, 2007) and science standards (Rutherford & Ahlgren, 1990; National Academy of Sciences, 1996). Curricula are now being retooled to focus on 21st Century skills, concepts, and integrated instruction for the delivery of content. Technology Education curricula is currently being re-visioned as Technology and Engineering Education to include enduring concepts (e.g. problem solving; teaming; creative and higher order thinking; physical and virtual modeling; research and development; technical communications; and communications through 2D and 3D, data and conceptual driven, graphic models).

Computational Modelling in Curricula

Modern curricula that support the concept of computational modelling require students to be visually literate in technology, engineering and design. This concept originated in 2002 from the national Coordination Office for Information Technology Research and Development sponsored by a Presidential Taskforce to look into 21st Century skills. The work of the taskforce lead to the establishment of the President's Information Technology Advisory Committee (PITAC) which defines computational science (i.e. modelling) simply as, "the application of computing capabilities to the solution of problems in the real world" (PITAC, 2005, p. 10). The more thorough definition includes algorithms, modeling, simulation, computer and information science, and computer infrastructure to solve problems related to STEM.

Computational science at the secondary and post-secondary levels is recognized as being a method for STEM integration because of the use of multidisciplinary approaches for teaching/learning and the use of tools (i.e. computers), and techniques (i.e. real world scenarios) that help students make the connections between the subject areas. These strategies utilized in computational science lend towards attracting students, including those recognized at-risk of dropping out of school, which, in the United States, is a national problem (Suh & Suh, 2006). Clark and Ernst (2010) utilized the work of the PITAC taskforce (see Figure 1) to compose the definition of computational modeling as, "the integration of science and technological literacy standards to transpire though the study of visualization and the development of both virtual (i.e. 2D and 3D) and physical models (i.e. prototyping)." By applying the methods as outlined

in the definition of computational science, true STEM integration can occur in Technology, Engineering, and Design Education classrooms that align with state and federal initiatives as intended for all students through the utilization of computational modeling.

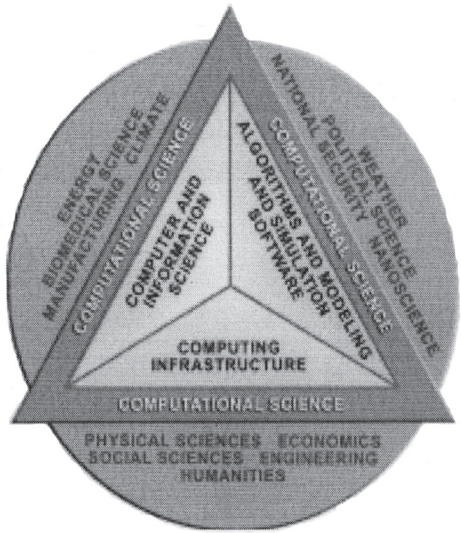

Figure 1. *Visualization for computational science using multidisciplinary approach* (PITAC, 2005 p. 11)

Dynamic Nature of CTE

CTE continues to utilize visual and kinesthetic reinforcement activities in group structured classroom settings to enhance learners understanding through engagement. CTE is concerned with the expansion of foundational skills, processing abilities, individual qualities, general competencies, and specific skill proficiencies (Scott & Sarkees-Wircenski, 2001). Problem-based learning, creativity strategies, design, and visual and kinesthetic strategies are effective methods for reinforcing STEM-based materials (Clark & Ernst, 2007). Powers and DeWaters (2004) indicated that project-based and problem-based approaches improve the learning of basic concepts and facilitate deep and creative learning regardless of the academic content area. The identification of science and mathematics concepts allows for the sequencing of instruction to reinforce these concepts through careful design and implementation of the identified CTE content.

Suh and Suh (2006) recognized an apparent relationship between educational engagement and high school degree attainment. Colley and Jamison (1998) found indication that at-risk students and students with disabilities enrolled in CTE programs are less likely to drop out of school when compared to students at-risk and with disabilities not enrolled in CTE. Further, students

at-risk and students with disabilities enrolled in secondary CTE programs are more likely to be employed, to have competitively paid jobs, and to work full time after high school than students at-risk and students with disabilities not enrolled in CTE.

For instance, Algebra is a major stumbling block for students in the United States (Schoenfeld, 2002). Therefore, Horn (2004) recognizes that raising mathematics requirements, as urged by policy makers is exacerbated by the high attrition in mathematics. Considerable research has been performed by Clark and Ernst (2007; 2008; 2009; 2010) indicating CTE coursework can be arranged to support and reinforce the teaching of mathematics through visual and hands-on virtual and physical modeling activities.

At-Risk and a Need for CTE

There are identifiable increases in the general student population dropout rate in the Southeastern United States. However, students participating in a sequence of CTE courses tend to complete high school at an elevated rate in comparison to their peers who do not enroll in CTE courses. For example, the graduation rate for at-risk students in North Carolina in 2008 was 70.3 percent. Of these students who were ninth graders in 2004-2005 and earned four or more related technical credits, 86.5 percent graduated. The proportional breakdowns for graduation rates of the general student body and students earning four or more CTE credits for 2006-2007 and 2007-2008 are provided in Fig. 2.

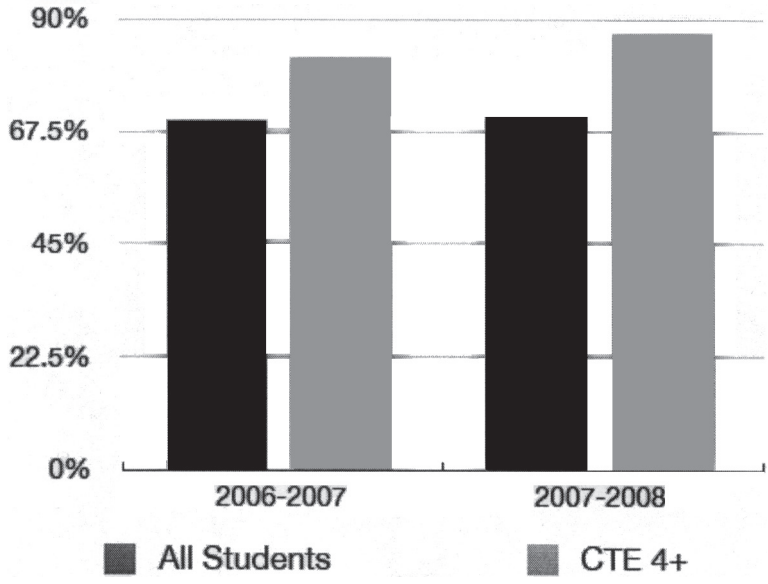

Figure 2. Graduation rates of all students and CTE 4 plus credits (Payne & Welfare, 2009).

The state of North Carolina served 25,267 students in its high school Technology Education courses in 2006. Of the 25,267 served, 13,752 students received special education services. Proportionally, of all CTE program areas, Technology Education ranks second behind Health Occupations Education in delivering services to students with disabilities, a subset of students categorized as at-risk. The term at-risk is used nationally "to describe students whose economic, physical, emotional, or academic needs go unmet or serve as barriers to talent recognition or development, thus putting them in danger of underachieving or dropping out" (NAGC, 2008). Wonacott (2001) asserts that at-risk students can gain considerable benefits from CTE. Brown (2003), through a synthesis of research indicates that students at-risk, including disadvantaged students and students with disabilities, experience a heightened degree of knowledge retention, academic success, and employment success when enrolled in Technology Education, school-to-career, technical preparation, and other CTE programs.

Virtual and Physical Modeling – Algebra I

Recognizing the status of high school degree completers and the benefits of CTE, the Technology Education Program, located in the CTE division of the North Carolina Department of Public Instruction, developed a curriculum titled Virtual and Physical Modeling to reinforce Algebra I. The content for the course is delivered utilizing existing Technology Education hands-on methods where the students spend a considerable amount of time creating virtual and physical models related to the content. By utilizing these methods, the students develop a greater understanding of the Algebra I content through the construction of tangibles and the communication of these constructions to their peers. The constructions are made utilizing low level graphics and communications programs for virtual modeling, and an assortment of materials (i.e. paper, cardboard, wood, tape, glue) for the physical modeling.

Technology Education teachers deliver the curriculum by design because of the teaching methods utilized in the curriculum. Each Technology Education teacher is teamed with an Algebra I teacher to insure the content is interpreted correctly. The content consists of the following seven curriculum units: 1) Teaming and Problem Solving, 2) Techniques and Safety, 3) Rational Numbers, 4) Real Numbers, 5) Fractions Illustration, 6) Measurement, and 7) Exponential Functions: Patterns and Graphs.

A pilot study was performed to test the Virtual and Physical Modeling curriculum. The requirements for student participation in the pilot study of the curriculum were: 1) to be identified by a trajectory software program as susceptible to unsatisfactory completion of Algebra I; 2) the student had to have previously failed eighth grade mathematics; 3) the student had to be enrolled in Algebra I at

the same time as being enrolled in Virtual and Physical Modeling. Results from the pilot study provided data that 47% of the student participants who took the Algebra I End of Course exam passed (Ernst & Clark, 2010).

Scientific and Technical Visualization

Traditionally in the United States, secondary students with an interest in future enrollment in university engineering and technology programs were limited to drafting courses (mechanical and architectural) to develop visual skills for use in these programs. Data existed indicating that mechanical and architectural drafting was not attracting all students (i.e., female, black, and Hispanic). The Scientific and Technical Visualization (SciViz) curriculum was developed in the mid 1990's, funded through a Tech-Prep Innovation grant, with the mission of developing needed visualization skills and geometry-based relations while enhancing student's scientific knowledge base (i.e., biology), and to be attractive to a broader base of students.

The SciViz curriculum is designed to have students use analytical (i.e., geometry) and communication tools to gain a better understanding and appreciation of the sciences, engineering and design concepts. Students also develop skills in the high demand and rapidly expanding imaging and information technology industries. Data indicate that many successful completers of SciViz programs enter the workforce as graphic visualization technicians, continue their study of scientific and technical graphics at a post-secondary institution, or further study the sciences and/or engineering at a university.

Student outcomes include advantages of using images and graphics versus text or numerical notation, thus enhancing the capacity for understanding and communicating complex relationships used by scientists, engineers and technologists. Program outcomes observed by SciViz teachers include an increased understanding and interest in science and geometry concepts with a reduction in student remediation in the sciences; improved presentation skills as applied to mathematical and scientific concepts; increased capabilities for using the Internet to access available data sets, process, and share information related to geometry and science; and enhanced capabilities to visualize in both two (2-D) and three (3-D) dimensions (Ernst & Clark, 2009).

SciViz has proven to attract a diverse population with at least 50% female and the majority of the students enrolled in the curriculum are college-bound. In addition, SciViz prepares students to work and learn independently, an important skill noted for the next generation of workers as the tools become more complex and the paradigm shifts from 2-D to a more complex 3-D mode of thinking. Further, the knowledge gained from SciViz is transferable to work related situations regardless of the chosen major.

Conclusions and Implications for Practice

Technology Education in the United States is moving toward an engineering and design focus. As the change becomes more apparent, conceptual modeling with related pedagogy and instructional practice will become standard practice. With the ever-changing workforce, new skillsets are needed to reflect the changing technological world. Through the experiences from the Virtual and Physical modeling curriculum project and SciViz initiatives, much is applicable for education within the United States and education abroad. Complex communication skills and experiences are no longer a preferred qualification, but a mandatory workforce competency in the 21st Century.

Current research indicates model STEM integration curriculum projects focused on virtual and physical modeling that actually enhance students' abilities in science, technology, engineering and mathematics. These projects also help to retain at-risk students in school and attract minorities to the Technology Education classroom. Further, students develop understandings and abilities where they transfer these new skillsets to settings in post secondary education and to real-world jobs.

STEM-based curricular design for at-risk students in CTE incorporates a truly new way of approaching Technology Education. If refined and widely implemented, this design allows for STEM content integration to take place in a meaningful way for students and contains potential to transform CTE curricular initiatives to target scientific and mathematical competencies, which is in direct alignment with federal and state initiatives in education within the United States.

Research findings from these studies indicate that teachers outside of their respective fields of study can teach a well-developed, comprehensive curriculum that uses psychomotor-based activities. One commonly identified teacher concern exists from this body of research. Given the nature of success of these curricula, many teachers do not perceive their role as academic support and do not wish to transform their designated curricular offerings to remedial support for science and mathematics. Considering these findings more research is needed on the role that Technology Education has in CTE, in STEM curricular integration, and as academic resource support.

Computers, the Internet, and robust computer software packages are the new basic for adequately tooled educational settings. These computer technology devices and applications serve as drivers of educational strategies and approaches. Educational leaders in leading and developing nations need to become aware of this driving force in education and seek opportunities to implement the associated strategies and approaches upon availability.

References

Anderson, L.W., & Krathwohl, D.R. (Eds.). (2001). *A taxonomy for learning, teaching, and assessing: A revision of Bloom's taxonomy of education objectives*. New York: Addison Wesley Longman.

Association for Career and Technical Educators (ACTE). (2008). *ACTE online: legislative issues – Perkins*. Retrieved from http://www.acteonline.org/policy/legislative_issues/Perkins_background.cfm

Brown, B. (2003). *The benefits of career and technical education: Trends and issues alert.* Washington, DC: Office of Education Research and Improvement. ED 481 326.

Clark, A. C., & Ernst, J. V. (2007). A model for the integration of science, technology, engineering, and mathematics. *The Technology Teacher*, *66*(4), 24-26.

Clark, A. C., & Ernst, J. V. (2008). STEM-based computational modeling for technology education. *The Journal of Technology Studies. 34*(1), 20-27.

Clark, A. C., & Ernst, J. V. (2009). Gaming research for technology education. *Journal of STEM Education. 10*(1,2), 25-30.

Clark, A. C., & Ernst, J. V. (2010). *Computational modeling: Projects and innovations for technology education*. Refereed proceedings of the International Association for Technology, Education, and Development's International Technology Education and Development Conference, Valencia, Spain., ISBN: 978-84-613-5538-9, 2056-2067.

Colley, D. A., & Jamison, D. (1998) Disabilities: Key indicators and policy implications. *Career Development for Exceptional Individuals 21*(2):145-160.

Ernst, J. V., & Clark, A. C. (2009). Technology-based content through virtual and physical modeling: A national research study. *Journal of Technology Education*, 20(*2*), 23-36.

Ernst, J. V., & Clark, A. C. (2010). *Virtual and physical modeling: A curricular design for at-risk students in career and technical education*. Refereed proceedings of the International Association for Technology, Education, and Development's International Technology Education and Development Conference, Valencia, Spain, ISBN: 978-84-613-5538-9, 1992-2000.

Horn, I. (2004). Why do students drop advanced mathematics? *Educational Leadership*, *62*(3), 61-64.

International Technology Education Association. (ITEA). (2007). *Standards for technology literacy: Content for the study of technology.* Reston, VA: ITEA. Retrieved from http://www.iteea.org/TAA/PDFs/xstnd.pdf

Murnane, R. J., & Levy, F. S. (2004). The new division of labor: How computers are creating the next job market. Princeton, NJ: Princeton University Press.

National Academy of Sciences. (1996). *National science education standards*. Washington, DC: National Academy Press. Retrieved from http://books.nap.edu/openbook.php?record_id=4962&page=R1

National Association of Gifted Children (NAGC). (2008). *Glossary of gifted terms*. Retrieved from http://www.nagc.org/index.aspx?id=565

North Carolina Department of Public Instruction (NCDPI). (2008). *North Carolina Standard Course of Study*. Raleigh, NC: Author. Retrieved from http://www.ncpublicschools.org/docs/curriculum/2008ncscos.pdf

Pannabecker, J. R. (1995). For a history of Technology Education: Contexts, systems, and narratives. *Journal of Technology Education, 7*(1), 43-56. Retrieved from http://scholar.lib.vt.edu/ejournals/JTE/v7n1/pdf/pannabecker.pdf

President's Information Technology Advisory Committee (PITAC). (2005). *Computational science: Ensuring America's competitiveness*. Arlington, VA: Author. Retrieved from http://www.nitrd.gov/pitac/reports/20050609_computational/computational.pdf

Powers, S. E., & DeWaters, J. (2004). Creating project-based learning experiences university-k-12 partnerships. *Published Proceedings of the American Society for Engineering Education Frontiers in Education Conference*, Savannah, GA, Session F3D

Rutherford, F. J., & Ahlgren, A. (1990). *Science for all Americans*. New York, NY: Oxford University Press. Retrieved from http://www.project2061.org/publications/sfaa/online/sfaatoc.htm

Schoenfeld, I. (2002). Looking for leverage: Issues of classroom research on "algebra for all". *Proceedings of the International Conference on the Teaching of Mathematics*, Hersonissos, Crete, Greece, Session 006 909.

Scott, J. L., & Sarkees-Wircenski, M. (2001). *Overview of career and technical education* (2nd ed.). Homewood, Illinois: American Technical Publishers, Inc.

Suh, S., & Suh, J. (2006). Educational engagement and degree attainment among high school dropouts. *Educational Research Quarterly, 29*(3), 11-20.

Wonacott, M. E. (2001). *Students with disabilities in career and technical education.* ERIC Clearinghouse on Adult Career and Vocational Education. ED459324.

Large Scale Workforce Planning Strategies: Issues in Conducting a Supply Analysis

George R. Maughan
Indiana State University, USA
Davison M. Mupinga
Kent State University, USA

Abstract

The need to determine workforce capacity in developing countries is an important task for government and business planners. Issues associated with acquiring and analyzing data about basic skills or advanced specialized knowledge within a current or potential workforce are complex. Yet existing data sources must be accessed in addition to the collection of localized data from existing government and private training institutions, schools, and pre-existing business entities. The compilation and synthesis of workforce supply data is primarily accomplished through blended quantitative and qualitative methods. However, the data may not be readily accessible from informal sectors, thereby presenting challenges in the design of effective workforce planning strategies. With reference to developing countries, this paper discusses issues to consider when conducting a workforce supply analysis and provides examples of useful resources.

Key Words: Supply analysis, developing countries, workforce planning strategies, workforce data, worker skill and knowledge

Introduction

The Business Dictionary (2011) defines workforce planning as "a systematic identification and analysis of what an organization is going to need in terms of size, type, and quality of workforce to achieve its objectives" (p. x). Workforce planning, therefore, is the process of determining the mix of experience, knowledge, and skills required to ensure that "the right people with the right skills are in the right place at the right time" (US Department of Interior, 2001, p.3). Therefore, workforce planning can be summed up as "an inclusive process, drawing together program management, strategic planning, budgeting, human resources, and program staff" (US Department of Health and Human Services, 1999, p. 1). As can be seen from the definition above, workforce planning requires good leadership skills and clearly articulated vision or mission.

Furthermore, workforce planning requires a lot of cooperation, collaboration, and information sharing among various country sectors. However, this collaboration and sharing of information can be a challenge in situations where data is not readily available.

Due to the off-shoring of manufacturing, research and service functions by many companies across the world, potential sites are considered in developing economies on an on-going basis. Two fundamental concerns are: 1) assessing the general business climate of a country, and 2) assessing infrastructure and workforce capacity. Complexities exist in performing both tasks; however, it is the assessment of current and future workforce capacity that can be the most difficult.

Large-scale workforce planning requires futuristic look at variables and situations within a country or combination of geographically or culturally linked countries in a region. According to a United States General Accounting Office (2003) report:

> "Strategic workforce planning addresses two critical needs: (1) aligning an organization's human capital program with its current and emerging mission and programmatic goals and (2) developing long-term strategies for acquiring, developing, and retaining staff to achieve programmatic goals" (p.2).

The task of workforce planning is further compounded by the size of potential workforce needed; large scale or small scale. Knowledge of employment trends, status of industrialization, risk of foreign investment, security and general economic growth rate sets a foundation for such work. The process of planning involves a strategic investigation into the attributes of existing and potential members of a workforce requiring a fairly broad view of data. Basic levels of literacy must be considered, while at the same time, the existence of specialized skill/knowledge/ability (S/K/A) must also be assessed.

For some developing economies, it is sometimes difficult to find workforce readiness data in a single location. Therefore, multiple information sources must be accessed, and in some cases, data must be taken from current industry/government sector employees or from students in vocational and technical training schools. These actions may be necessary when a company or government sector wishes to expand the footprint of an existing operation in a developing economy and they may also be needed when an entirely new entity is being considered. A third reason to employ workforce planning strategies is to examine whether or not a country has a severely under-utilized or underdeveloped workforce that has great capacity in fulfilling the needs of a governmental or business.

Innovation, technology transfer and economic development are powerful agents of change for corporations, countries and entire geographic regions. Purpose-driven innovation and technology transfer to increase profits or improve the quality of life of citizens tends to create a climate for change. New technologies such as the manufacture of low-cost, high efficiency solar panels or large wind turbines can make relatively new demands on a workforce. So too can new work procedures in an existing plant, or the industrialization of a traditionally agricultural region.

Among macroeconomic conditions, it is the supply analysis of human capital aspect in developing countries that is the focus of this article, more specifically, the identification of strategies that could be used to assess large-scale workforce potential for planning purposes. Although the overall development and execution of a workforce plan is not truly linear, Anderson (2004) suggests a viable four step process: 1) Supply analysis, 2) Demand analysis, 3) Gap analysis, and 4) Solution analysis (p. 363). This process requires modifications when new economic development, technology transfer and off-shoring occurs that influences regions beyond a localized perspective.

Informal and Formal Sectors

Differentiating informal and formal economic sectors, especially in developing economies, is important when assessing potential workforce. The numbers are surprising. According to a co-publication of The World Bank and the International Finance Corporation (2010), *Doing Business,* "globally, 1.8 billion people are estimated to be employed in the informal sector, 1.2 billion in the formal sector" (p.8). Typically, the informal sector of an economy tends to operate loosely or entirely under the radar of the government. Factors such as work rules, taxes, and employment patterns are not often monitored by government agencies. The informal sector is loosely established and frequently organized by self-employed or business owner/operators and those working in micro-industries. Some informal workers assemble parts at home as outworkers for various industries while others might pick scrap metal from trash piles. Example of informal sectors from Africa include: the *Jua Kali* (under the sun) industries in Kenya and the *Siya-So* (loosely translated means 'stay out of it') Home Industries in Zimbabwe.

Kenya's informal sector constitutes 98 percent of all businesses in the country, absorbs annually up to 50 per cent of new non-farm employment seekers, has an employment growth rate of 12-14 percent, and contributes 30 percent of total employment and 3 percent of GDP (Riley & Steel, 2000 p.1). Similarly, the informal sector in Zimbabwe was estimated to be 59.4% of GDP in 1999-2000 (Schneider, 2002). In many countries, employees in the informal sector

tend to have fewer rights and lower wages than their counterparts working in the organized sector. In addition, many informal sector workers do not have to register and may not be licensed to operate their businesses. Consequently, it is very difficult for any government agency to account for these workers. These workers do, however, possess some knowledge, skills and abilities which may, or may not, translate to the formal sector.

Experienced labor in the informal sector does not migrate to the formal sector nor have these workers progressed to higher-level skills on a large scale (Chen, 2005). Yet, it is important to note that when considering the overall potential of a workforce that includes significant numbers of workers in informal businesses, one of the most difficult things to do is assess and predict the degree to which these informal workers might transfer their knowledge and skills to the formal sector. This becomes more critical when one considers the increased emphasis on entrepreneurialism which is encouraged in many countries as well as the associated knowledge and skills which often develop through this effort.

On the other hand, it's more likely that industry councils or government agencies will have fairly accurate data on the numbers of workers and their knowledge and skill sets when they work in the organized or formal sector of the economy. The formal sector of the economy tends to be made up of larger business entities which are regulated by the government such as banks, utility companies, large manufacturing firms, tourism and transportation. Formal sector enterprises tend to be far more capital intensive than their informal counterparts. These industries and the workers pay taxes, operate under some regulation or oversight, organize training, and workers earn wages.

While both sectors are important and complement each other, it's the informal sector which can often comprise up to 50% of the labor force in developing countries (United States Agency for International Development [USAID], 2011) that often presents challenges when developing workforce plans. The informal sector can be essential to countries as they act as both an economic safety net for the poor or those laid off as countries down-size their formal sector activities and a source of small-business innovation and entrepreneurial talent. In many countries, the sector represents well over two-thirds of all economic activity.

Workforce Planning Considerations and Data Sources

Whether identifying workers in the formal or informal sector, the issue of scale is important. Assessing workforce capacity of a collection of small communities is different than assessing a region made up of several countries. Of course one important variable to consider is population density. Secondary to that is

transportation. Many potential employees will take a train or bus for a good job. Likewise, many employers will provide buses or vans to transport workers to their work site. These variables are especially critical when considering: a). employee turnover, and b). potential expansion of workforce.

The broad view is important when beginning a large scale workforce plan. Country-specific information that includes literacy rates, government structure, economy, geography, communications, transportation, and transforming issues for 267 world entities is available in the *The World Factbook* (see, Central Intelligence Agency [CIA], 2011). Two other significant sources of information about the world-wide organized workforce are: 1) The International Labor Office "Global Employment Trends" series (available at: www.ilo.org), and 2) The World Bank Group series "Doing Business," (available at: www.doingbusiness.org). Each source provides extensive data on a range of issues associated with workforce in specific countries and regions. Updated annually, these sources should become a cornerstone of any workforce planning strategy.

In-country government and industry council reports, if available, should not be overlooked. Checking for more than one source for this data is necessary because various governmental agencies may be officially charged to collect and analyze this data. Some of the data will have been compiled by the government itself, however, some sector or industry-specific data may be the result of an external development agency project funded by a developed country. Occasionally, formal sector industry councils or working groups may collect workforce data on their industry. For example, a cement industry council or a manufacturing industry council may exist to analyze their industry and workforce in order to share information. If industry councils do not exist or are not active it would be wise to help create these if your organization is committed to a specific country or industry.

Some industry groups publish a newsletter. For example, a recent Olive Oil Council newsletter, Olive Oil Times, reported that Morocco plans to modernize its olive oil industry and significantly increase production (www.oliveoiltimes.com). There are powerful implications here for workforce planning.

In addition to government-sponsored schools, training is provided by government "induction training" programs intended to prepare young adults for work in government agencies across a country. Programs may last from a few weeks to two years. These programs cover topics such as orientation to a specific agency, for instance, the irrigation department or the telecommunications sector. Often programs for re-retraining and advanced training for in-service employees will be provided by the same training center. A good example of this is Maharashtra state in India. The state offers approximately two dozen training courses on water and water management (www.pravinkolhe.com/indtraining.html). These government training centers help develop basic work-

force skills, and in more sophisticated centers, represent a culture which values education and training for adults.

A decade ago, efforts were made to downsize civil services in a number of African countries. Occasionally, both skilled and un-skilled workers left government due to retirement or incentives to seek other opportunities (Lienert, 1998). It is reasonable to believe that some used their government provided training in private sector jobs.

The ability to assess workforce needs and to plan to ensure that the skills and knowledge necessary to perform new jobs are available is aided by a mature education/training system at the primary and secondary level. Many countries have such data available for its schools. Private primary and secondary schools may or may not readily provide the same data. Usually, there is no common affiliation of private schools across the country that would provide collective data unless the government requires them to do so.

Technical and vocational schools too can be government controlled or private. Of course, it is likely that all private schools of this nature have a license to operate but they may not have useful data to share. Trade/technical schools or community colleges or as they might be known in some countries polytechnics are another source of workforce planning data. In India, there are more than 31 of these schools scattered around the country. In Tanzania, vocational training can be found in national vocational training centers and Folk Development Colleges (Rogers, 2000). Vietnam boasts of over 300 technical and vocational education training colleges and schools (Ministry of Education and Training, Vietnam, 2006). Curriculum and skills outcomes vary widely across any broad collection of technical and vocational schools. However, the numbers of graduates from these institutions provide some indication of workforce capacity. A closer look at this information is recommended for a specific geographic region.

Industry-specific or plant-specific information including pre-hiring screening data is a useful measure of workforce capacity in a specific locale. Existing plants may be willing to share this information with workforce planners. This is especially true when companies believe that there is excess labor capacity and that the local business would benefit from other nearby plants. Information about successful hiring criteria and the nature of local pre-hiring screening data, including things like literacy, knowledge or aptitude tests is extremely helpful.

Individual-level skill/knowledge/ability (SKA) assessments are scalable. They can be developed by current supervisors and workers who can administer the instruments throughout an organization on a national scale or in specific micro regions within a country. Workers typically apply a variety of knowledge and skills each day. These range from performing manipulative tasks, dealing with customers, troubleshooting problems (both technical and otherwise) and supervising others. The design of these assessments should be

performed with care to ensure both reliability and validity. There are many examples of these instruments in the marketplace; however, they almost always need to be revised to the local work requirements and culture. A web search for job skill lists or training needs assessments will result in a good beginning.

For both formal and informal workforce sectors, portability of skills and knowledge is an important factor when planning for the development or retasking of a workforce. Farmers may have mechanical skills or aptitudes that can be applied to other jobs, for example, tractor driving may translate to other heavy equipment operation. Traditional crafts such as pottery making or textile dying may require tasks associated with precision measuring, eye-hand coordination, or dealing with the temperature treatment of materials. On a more high-tech level, experience in the precision manufacturing of automobile parts is likely to transfer to the micro-manufacturing of medical equipment components. The International Labor Office Committee on Employment and Social Policy (2007 as cited in Department of International Development [DFID, 2011]) states that transferability of skills is based on a competence necessary in the performance of a job or task. They state, "Competence is defined in a broad sense, comprising vocational, social, communication, cognitive, learning and personal behavior skills" (p.6). These skills are both implicit and explicit. The portability aspect of skills includes: a). the recognition and certification of skills, and, b). the ability to use skills in a productive fashion across different jobs and industries. Recognizing that the needs of any new or transforming venture can vary greatly relative to workforce knowledge and skills, some type of algorithm for major job categories might be created to assess the transferability of skills. Therefore, skill portability can be a critical factor in assessing workforce potential in a country or region.

Data Collection and Analysis

The compilation and synthesis of workforce supply data is primarily accomplished through blended quantitative and qualitative methods. Due to the kaleidoscope of data necessary to perform large-scale workforce planning, the fundamental method of analysis should be the use of constant comparative methods (grounded theory). Interview data must be considered as well as curricula topics, numerical information about graduates of school and training institutions. Data from industry on job types and skill levels will also be integrated into the big-picture synthesis of workforce supply. Planners will need to read and re-read data and perhaps use triangulation, for example, comparing catalogue descriptions of curriculum with interview data. This may also include the use of data provided by other researchers and planners to ensure accurate analysis of data.

By combining multiple data sources and employing analytic tools and instruments, workforce planners can contribute much to the discussion about expanding or off-shoring work to developing countries. The accurate assessment of workforce capacity, from basic skills to those with world-class specialty knowledge, is highly valuable for all concerned.

Online Resources

There are several online resources useful to workforce planners. These sources range from governments or industry specific commission/councils, outsourcing agencies, consultant reports, and industry publications as well as Blogs. The following listings are examples only; a search of the Internet is recommended for other useful and current resources.

Government Labor Skill Standards Boards or Commissions:
United States Department of Labor (http://www.dol.gov),
Energy & Utility Skills (www.euskills.co.uk/power),
Botswana Investment Climate Assessment (http://siteresources.worldbank.org/EXTAFRSUMAFTPS/Resources/bw_ica.pdf),
The Inter-American Centre for Knowledge Development in Vocational Training (http://www.oitcinterfor.org/)
Industry Group Standards Councils/Industry-Specific Associations
China Light Industry Council (http://218.247.4.32/english/superior/superior1.asp),
Manufacturing Skill Standards Council (www.msscusa.org)
Outsourcing Services Agencies/Companies:
Outsourcing Trade Association (www.noa.co.uk),
Industry Specific Associations
Sri Lanka Apparel Exporters Association (http://srilanka-apparel.com),
SHRM-Global Professional in Human Resources (GPHR) (http://www.shrm.org/hrdisciplines/global/Pages/default.aspx)
Consultant Reports
A.T. Kearney's Offshore Location Attractiveness Index (http://www.atkearney.com/index.php/Publications/global-services-location-index-gsli.html)
Industry Publications:
Individual or clustered by media groups (www.einnews.com/)
Blogs and Forums:
Chemical Engineering Blogs (www.chempro.org)

Summary and Implications

While there are several models for workforce supply analysis planning, according to the US Department of Health and Human Services (1999), effective workforce planning relies on an analysis of present workforce competencies; an identification of competencies needed in the future; a comparison of the present workforce to future needs to identify competency gaps and surpluses; the preparation of plans for building the workforce needed in the future; and an evaluation process to assure that the workforce competency model remains valid and that objectives are being met.

Nothing stays the same. Regional development, economic factors, cultural norms, age and gender roles, rising expectations of citizenry, and innovation are on the move in traditional cultures as well as developed cultures. Planners must stay future oriented and strategic. Each organization or government opportunity seeker must be able to understand their specific SKA needs or their ability to take advantage of an under-utilized workforce in order to identify gaps between current situation and desirable outcome. Planners can overcome many workforce deficiencies with a solutions plan that involves active partnerships, mergers, insightful hiring programs, efficient training, and strategic redeployment of in-house experts. These strategies must be on-going and transition from start-up to mature organizations/industries.

While agencies' approach workforce planning differently, the United States General Accounting Office (2003, p 2), identified five key principles that strategic workforce planning should address irrespective of the context in which the planning is done:

1. Involve top management, employees, and other stakeholders in developing, communicating, and implementing the strategic workforce plan.
2. Determine the critical skills and competencies that will be needed to achieve current and future programmatic results.
3. Develop strategies that are tailored to address gaps in number, deployment, and alignment of human capital approaches for enabling and sustaining the contributions of all critical skills and competencies.
4. Build the capability needed to address administrative, educational, and other requirements important to support workforce planning strategies.
5. Monitor and evaluate the agency's progress toward its human capital goals and the contribution that human capital results have made toward achieving programmatic results.

A final implication for large-scale workforce planners is to seek existing data as well as ask institutions to help collect relevant data where none exists. For example, if private trade or technical schools do not have accurate data on

graduates by skill-sets, then a request for planners or government representatives may be appropriate (see, Figure 1 for workforce planning strategies when conducting a supply analysis)

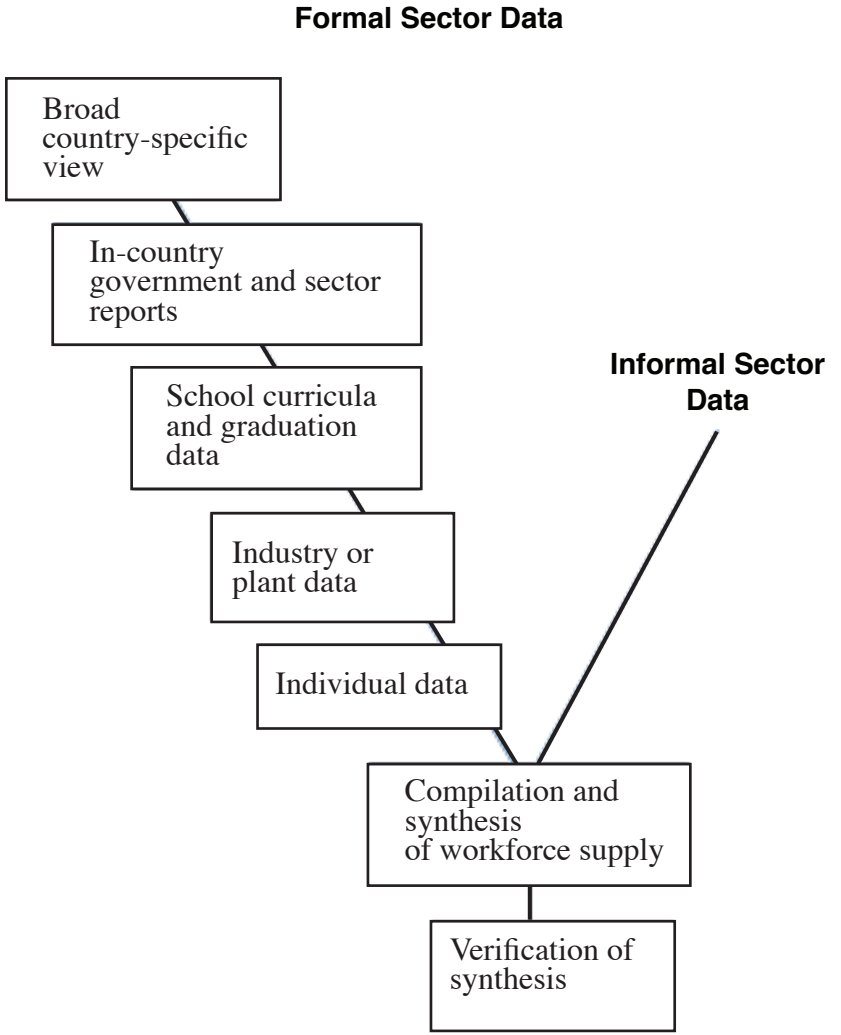

Figure 1: Elements of large-scale workforce planning strategies for supply analysis

References

Anderson, M. W. (2004). The metrics of workforce planning. *Public Personnel Management. 33*(4), 363-378.

Business Dictionary, (2011). Workforce Planning. Retrieved from http://www.business-dictionary.com/definition/workforce-planning.html

Chen, M.A. (2005, April). Rethinking the Informal Economy Linkages with the Formal Economy and the Formal Regulatory Environment. EGDI, United Nations University, Research Paper No. 2005/10

Central Intelligence Agency, (2011). The World Fact Book. Retrieved from https://www.cia.gov/library/publications/the-world-factbook/

International Labor Organization, (2011). Global employment trends 2011: The challenge of a jobs recovery. Retrieved from http://www.ilo.org/global/publications/books/WCMS_150440/lang--en/index.htm

DFID, (2011). Engaging the private sector in skill development. Guidance Note: A DFID Practice paper. Retrieved from http://www.dfid.gov.uk/Documents/publications1/eng-priv-sect-skills-dvmt.pdf

Lienert, I. (1998). Civil service reform in Africa: Mixed results after 10 years. IMF. Retrieved from http://www.imf.org/external/pubs/ft/fandd/1998/06/lienert.htm,

Ministry of Technical Education and Training, Vietnam, (2006). Technical and Vocational Education and Training (TVET) in Vietnam. Retrieved from http://en.moet.gov.vn/?page=6.7&view=4403

Riley, T.A., & Steel, W.F. (2000). Voucher Program for Training and Business Development Services Kenya Micro and Small Enterprise Training and Technology Project. Retrieved from http://www.ilo.org/public/english/employment/ent/papers/voucher1.htm

Rogers, A. (2000). Cultural Transfer in Adult Education: The Case of the Folk Development Colleges in Tanzania. *International Review of Education, 46*(1/2), 67-92.

Schneider, F. (2002). Size and measurement of the informal economy in 110 countries around the world. Paper presented at Workshop of Australian National Tax Centre, ANU, Canberra, Australia, July 17, 2002. Retrieved from http://www.amnet.co.il/attachments/informal_economy110.pdf

The World Bank and the International Finance Corporation, (2010). Doing Business 2011: Making a difference for entrepreneurs. Retrieved from http://www.doingbusiness.org/~/media/fpdkm/doing%20business/documents/annual-reports/english/db11-fullreport.pdf

USAID, (2011). Making cities work: Programming considerations of local economic growth. Retrieved from http://www.makingcitieswork.org/urban-theme/programming-considerations-local-economic-growth

US Department of Interior, Office of Personnel Policy, (2001). Workforce Planning Manual. Retrieved from http://www.doi.gov/hrm/WFPImanual.pdf

US Department of Health & Human Services, (1999, November). Building Successful Organizations Workforce Planning in HHS. Retrieved from http://www.hhs.gov/ohr/workforce/wfpguide.html

United States General Accounting Office, (2003). Human Capital: Key principles for effective strategic workforce planning. Highlights of GAO-04-39. December 2003. Washington DC. Retrieved from http://www.gao.gov/new.items/d0439.pdf

Advancing the Affective Domain for Vocational Education Research

Sunyoung Park
Indiana University, USA
Doo Hun Lim
University of Oklahoma, USA
Seung Won Yoon
Western Illinois University, USA
Yeol Huh and DaBae Lee
Indiana University, USA

Abstract

The purpose of this study was to clarify core concepts and components in the affective domain, review current affective taxonomies or typologies for a consistent and comparable evaluation framework, and synthesize existing affective intervention areas that are important in vocational education and organizational contexts. Through the integrative literature review, 86 affective intervention areas were identified and categorized into six groups: (a) emotions, (b) motivation, (c) self development, (d) value, (e) affective team development, and (f) organizational behavior, and outcomes commonly measured were identified. Implications for practices and future research are also discussed.
Keywords: affective domain, taxonomies, typologies, affective intervention areas

Introduction

The affective domain is considered a critical aspect of learning and performance but is an under-researched area in vocational education and organizational research (Lewis, Watson, & Schaps, 1999). Scholars state that the development of the affective domain in individual and organizational levels helps improve interpersonal relationships (Nussbaum, 1983), create a positive climate (Russell, 2004), evaluate performance (Hirt, Levine, McDonald, & Melton, 1997), improve employees' intercultural competencies (Savicki, 2008) and soft skills (Cleveland-Innes & Ally, 2004), and leads to occupational success (Butler, 1972), and enhanced problem-solving (McLeod, 1988), and effective decision-making (Sadler & Zeidler, 2005). Numerous disciplines, such as

business, education, engineering, information science, and medicine, recognize the importance of the affective domain in curricular or professional development (Brown, Ferrill, Hinton, & Shek, 2001; Dumas, 1989; Lynch, Russell, Evans, & Sutterer, 2009; Nahl & Bilal, 2007).

Interests in the affective domain have surged in the field of vocational education, Human Resource Development (HRD), business, and management as illustrated in recent publications on related topics, such as Emotional Intelligence (EI), motivation, creativity, justice, power, and employee satisfaction. Exemplary studies include how motivation and emotional experiences influence learners within vocational educational environments (Lewalter & Krapp, 2004), and how EI affects conflict resolution (Jordan & Troth, 2002) or perceived leadership effectiveness (Weinberger, 2009). Recently, studies on organizational learning and knowledge reported that elements of the affective domain such as open-mindedness, emotion, motivation, feeling, and value, are essential aspects of learning as well as knowledge sharing within organizations (Ardichvili, 2008; Vince, 2002). Despite the promising results these studies report, researchers and practitioners alike have encountered difficulties in identifying which areas of interventions comprise the affective domain and how they should be designed or measured in an organization.

Problem Statement

Difficulties in defining and promoting the affective domain in vocational education and organizational research may be attributed to the fact that efforts to synthesize numerous affective terms have been rare (Garber, 1996). Examples include attitudes (consisting of beliefs, emotions, and actions) (Gagné, 1984); affective skills (Hoepfner, 1972); affective behaviors (Griffitt, 1970); attitudinal and motivational outcomes (Kraiger, Ford, & Salas, 1993); and interests, appreciation, values, and emotional sets (Krathwohl, Bloom, & Masia, 1964). These studies attempted to define the affective domain based on personal characteristics at the individual level. However, studies showed that training contexts created different goal orientation responses affecting members' participation and motivation (Stevens & Gist, 1997). In order to advance theory and research in the affective domain, synthesizing existing concepts with intervention areas would appear to be a warranted first step.

Research Questions

The purpose of this study was to (a) clarify the core definition and components of the affective domain, (b) review and compare existing taxonomies or typologies, and (c) identify popular and important affective intervention areas

in organizational contexts. In pursuing our research purposes, the following research questions were developed.

1. What are the core definitions and components of the affective domain?
2. Which taxonomies or typologies have been developed, and how do they compare?
3. What kinds of intervention areas are common, and what are their effects in organizational contexts?

Methods

The procedure of the integrative literature review suggested by Torraco (2005) was used to reconceptualize and synthesize the mature topic of the affective domain. Existing definitions and their theoretical foundations and taxonomies or typologies were reviewed for strengths and weaknesses, and then this knowledge was used to identify and classify popular affective intervention areas in organizational contexts. For the literature selection, we used Google Scholar, Business Source Premier, and the Education Resources Information Center (ERIC) databases. Initially, we searched for the appearance of mixed terms, such as "emotion and vocational education", including the following terms within the title or abstract: value, feeling, emotion, affective, attitude, Human Resource Management (HRM), HRD, management education, business education, workforce, and worker. We limited our search to studies conducted between 1967 and 2009. We also combined taxonomy or typology with related terms, such as "affective domain" and "affective learning". In addition, books from industrial and organizational psychology and related journals, such as *Journal of Organizational Behavior*, *Personnel Psychology*, *Journal of Applied Psychology,* and *Journal of Occupational and Organizational Psychology* were reviewed. In total, 118 studies and 239 intervention areas related to the affective domain were identified. Among 239 intervention areas, overlapped expressions were integrated as one word reflecting the commonality. For example, importance of work value, work value orientations, and work values were re-expressed as "value" because they represent the value the individual has about work. Likewise, self-appraisals, self-assessment, and self-evaluation were represented as "self-evaluation" in that they illustrate making judgments about one's own work. Through this process, we have narrowed down 239 intervention areas to 86 areas.

In conducting our literature review, with an intentional focus on positive characteristics of the affective domain, we excluded negative and aggressive expressions in affective intervention areas (e.g., stress and hatred) and professional terms in the field of psychopathology (e.g., antisocial disorder). In addition, we intentionally omitted expressions reflecting general characteristics such as personality, temperament, and leadership due to their generality.

Findings

Research Question 1. What are the core definitions and components of the affective domain?

In defining the affective domain, many scholars expressed concerns about the lack of conceptual clarity (Gephart & Ingle, 1976; Horne, 1980; Laforgia, 1988), the ambiguous and controversial nature of the topic (Ringness, 1975), differing perceptions on the importance of the topic (Bills, 1976), and its oversimplification, which mingles non-cognitive and non-psychomotor topics all together (Martin & Briggs, 1986). Bloom, Masia, and Krathwohl (1964) first defined the affective domain as human reactions or responses to content, subjects, problems, or areas of human experience. Ringness (1975) also claimed, "Strictly speaking, any behavior that has emotional tone lies within the affective domain, which is why emotions themselves belong to it. Some behaviors have a higher cognitive component than emotions; per se, yet also have a definite emotional tone" (p. 19). Briefly, the affective domain includes all behaviors related to emotions and feelings, affective development/education as internal changes or processes, and internalization of interest, attitudes, and values (Martin & Briggs, 1986; Martin & Reigeluth, 1999; Lynch et al., 2009).

Along with efforts at defining the affective domain, researchers have identified core components of the domain in order to clarify its scope and boundary (Gephart & Ingle, 1976; Martin & Briggs, 1986; Snow, 1989). For example, Bloom et al. (1964) included attitudes, feelings, and values, whereas Ringness (1975) listed interests, tastes, preferences, attitudes, values, morals, character, and personality adjustment. In addition, Hoepfner (1972), Gephart and Ingle (1976), Martin and Briggs (1986), Snow (1989), Himsl and Lambert (1993), Zytowski (1994), Hattie, Biggs, and Purdie (1996), Clayton and Sankar (2009), and Lynch et al. (2009) identified essential components in the affective domain. Table 1 presents these parts or components of the affective domain listed by various scholars.

Numerous concepts related to components from Table 1 were examined within organizational contexts (Hattie et al., 1996). For example, in the area of human resources, researchers have studied the issues of internal motivation (Fertig, Zeitz, & Blau, 2009), value creation (Hughes, 2010; Maatman, Bondarouk, & Looise, 2010), and self-efficacy (Potosky, 2010). In organizational behavior, studies explored motivating effects (Fagerstrøm, 2010), trusting relationships (Hempel, Zhang, & Tjosvold, 2009), and self-esteem (Scott, Shaw, & Duffy, 2008). In the field of industrial and organizational psychology, scholars examined concepts of team capability beliefs (Collins & Parker, 2010), perceived justice (Lipponen & Wisse, 2010), and multiple self-concept images (Nolan &

Table 1

Components of the Affective Domain

Researcher(s)	Year	Components of Affective Domain
Bloom et al.	1964	Attitudes, Feelings, Values
Ringness	1975	Interests, Tastes, Preferences, Attitudes, Values, Morals, Character, Personality adjustment
Gephart and Ingle	1976	Physiological (Perspiration, Heart rate, Respiration, Visceral responses), Psychosocial behaviors and responses (Attitudes, Beliefs, Values, Emotions, Perceptions)
Sinclair	1985	Motivation of behavior, Maintenance and enhancement of self-esteem, Anxiety and achievement motivation, Development of curiosity, exploratory behavior, a need-to-know and understand, Social motives (a need for praise, recognition and attention)
Martin and Briggs	1986	Self-concept, Motivation, Interests, Attitudes, Beliefs, Values, Self-esteem, Morality, Ego development, Feelings, Need achievement, Locus of control, Curiosity, Creativity, Independence, Mental health, Personal growth, Group dynamics, Mental imagery, Personality
Snow	1989	Goals, Motives, Values
Himsl and Lambert	1993	Self-esteem, Interpersonal relationships, World awareness, Motivation, Spiritual life
Zytowski	1994	Needs, Values, Preferences, Interests, Traits, Attitudes
Hattie et al.	1996	Motivation, Belief, Value, Interest, Self-concept
Clayton and Sankar	2009	Attitudes, Beliefs, Feelings, Motivations
Lynch et al.	2009	Internalization of interest, Attitudes, Values

Harold, 2010). Concepts that appear in recent organizational research studies and components reviewed in Table 1 show that the definition and components of the affective domain in organizational research should capture the origination and outcome of members' intentions and behaviors.

Accordingly, the affective domain can be clarified as the different areas of affective characteristics, which (a) are affected by individuals' goals, beliefs, personality, spirituality, and value, cultural, and moral systems; (b) influence individuals' thinking processes, decision making, emotions, and behaviors; (c) form predictable patterns of attitudes; and which (d) result in individual-level outcomes such as affective, cognitive, and behavioral decisions as well as organizational-level outcomes (e.g., organizational commitment, empowerment, engagement, satisfaction, or enhanced performance). Such a view can help clarify the origination, goal, behavior or cognitive choice, and intended outcomes of various affective concepts. For instance, organizational commitment can qualify

as an affective concept as "feelings and/or beliefs concerning the employee's relationship (*cognitive choice,* italics our own) with an organization" (Meyer & Allen, 1991, p. 62). Similarly, employee engagement is "an individual employee's cognitive, emotional, and behavioral state (*sources*) directed toward desired (*goal*) organizational outcomes" (Shuck & Wollard, 2010, p. 103). Another direction that has been taken in the past was to create an exhaustive taxonomy or typology in order to clarify the components of the affective domain.

Research Question 2. Which taxonomies or typologies have been developed, and how do they compare?

Although taxonomy and typology are used interchangeably, Webster® defines taxonomy as a study of classification based on natural relationships and typology as a study of common types, especially based on types of categories. In education, Bloom's (1956) classification of different levels of learning objectives popularized the use of taxonomies. Using the taxonomy approach in education offers great advantages for scholars and practitioners. "A domain taxonomy in education allows us to classify terms, concepts, goals or outcomes, assessment instruments and/or lesson plans that are directed toward particular outcomes" (Martin & Briggs, 1986, p. 57).

Krathwohl, Bloom, and Masia (1964) developed a taxonomy of affective learning, in the order of internalization of the affective state: (a) receiving, (b) responding, (c) valuing, (d) organization, and (e) characterization by a value or value complex. Brandhorst (1978) suggested a three-fold taxonomy: (a) a taxonomy with an ego-involvement orientation, (b) a taxonomy with a motivation orientation, and (c) a taxonomy with a moral development orientation. Martin and Briggs (1986) attempted to integrate the cognitive and the affective domain, and presented a view in which self-development is the ultimate goal of learners and tried to demonstrate causality among affective components towards self-development. In addition, Martin and Reigeluth (1999) proposed a typology that included six process-related dimensions (emotional, moral, social, spiritual, aesthetic, and motivational development), and three major product components (knowledge, skills, and attitudes). Table 2 is a summary of major taxonomies and typologies reviewed.

Existing taxonomies of the affective domain from Table 2 show that scholars created taxonomies to accomplish different goals. Krathwohl et al.(1964) and Dettmer (2006) attempted to integrate the learner's knowledge with behaviors to facilitate the characterization and internalization process, while Martin and Briggs (1986) and Martin and Reigeluth (1999) focused on the development of self on multiple dimensions beyond cognitive skills. For Brandhorst (1978), his taxonomy tried to explain differing growth needs and processes of self-image, motivation, and morality.

Table 2
Summary of Affective Domain Taxonomies

Researchers	Categories	Components
Krathwohl et al. (1964)	Receiving	Awareness, willingness to receive, controlled or selected attention
	Responding	Acquiescence in responding, willingness to respond, satisfaction in response
	Valuing	Acceptance of a value, preference for a value, commitment (conviction)
	Organization	Conceptualization of a value, organization of a value system
	Characterization	Generalized set, characterization
Brandhorst (1978)	Ego-involvement	Objectivity, empathy, response delay, impulse suppression, transformation
	Motivation	Perceptual awareness, perceptual synthesis, risk-taking, concentration, playfulness
	Moral development	-
Martin and Briggs (1986)	Self-development	Attributions, social competence, values and morals (attitudes, emotions, feelings), motivation (interest)
Martin and Reigeluth (1999)	Emotional, moral, social, spiritual, aesthetic, motivational development	Knowledge, skills, attitudes, others
Dettmer (2006)	Receiving	Awareness, willingness to receive, controlled or selected attention
	Responding	Acquiescence in responding, willingness to respond, satisfaction in response
	Valuing	Acceptance of a value, preference for a value, commitment (conviction)
	Organization	Conceptualization of a value, organization of a value system
	Characterization	Generalized set, characterization

Research Questions 3. What kinds of intervention areas are common, and what are their effects in organizational contexts?

For-profit organizations recognized the importance of the affective domain in the late 1970s (Ashkanasy, Härtel, & Zerbe, 2000). Organizational researchers have not used the term "affective domain" in research. Instead, they used the terms "emotion" (Fredrickson, 2003), "positive psychological trait" (Peterson & Seligman, 2004), and "positive organizational behavior" (Luthans, 2002) to

study the affective domain in organizational contexts. Although different terms have been used, they share one commonality: they are mainly concerned with desirable outcomes, processes, and attributes of organizations and employees in terms of emotional and psychological traits.

In categorizing various types of affective intervention areas, based on our preliminary literature search, we define the affective intervention areas as positive psychological and emotional approaches/solutions that create developmental climates and lead toward positive behaviors and attitudes in organizational contexts. Our literature search on the affective domain within organizational contexts helped us identify different types of affective and positive organizational variables, such as organizational commitment, spirituality, trust, and EI, and they all indicated positive empirical relationships with individual or organizational performance. In total, 86 affective intervention areas were identified and categorized into six groups according to individual, group, and organizational levels: (a) emotions, (b) motivation, (c) self development, (d) value, (e) affective team development, and (f) organizational behavior. Table 3 shows the list of intervention areas grouped around the six categories. At the level of the individual, emotion, motivation, self-development, and value were selected as key terms representing each category based on Table 1 and 2. In particular, the category of motivation included cognitive parts such as recognition and perception because of the important role of cognition in motivation (Latham & Locke, 2009). At the group and organizational levels, affective team development and organizational behavior were used based on books and articles in the field of industrial and organizational psychology. The consensus on the final grouping was made based on the authors' continuous discussions.

For those 118 studies and 239 intervention areas we retrieved from search engines and journal articles, the following section presents intervention areas related to organizational performance variables at the individual, group, and organizational levels.

Motivation in the form of professional reputation and self-esteem affected knowledge sharing in virtual communities of practice (Ardichvili, 2008). In team learning settings, individual motivational states played an important role in establishing group cognition and team climate (Kozlowski & Bell, 2008). Positive relationships were found between motivation and individual performance (Jalajas & Bomme, 1999). As for workplace learning, Gallagher and her colleagues (2007) examined relationships between cognition, feelings, and behavior in learning and found that spirituality affected the participation and effectiveness of workplace learning.

Organizational commitment was positively correlated to increasing organizational adaptability (Angle & Perry, 1981) and decreasing turnover intention (Powell & Meyer, 2004). According to Ulrich and his colleagues (1991),

Table 3
Types of Affective Intervention Areas

Category	Intervention Areas
Individual Level	
Emotions *11 areas*	***Affect**, care (caring), **emotion**, **emotional intelligence**, **empathy**, enthusiasm/passion/vigor/zest, feelings, hope, love, **mood**, and playfulness.*
Motivation *16 areas*	*Acquiescence, acceptance, attention, **curiosity**, expectancy, **goal-setting**, **goal attainment**, **goal-orientation**, interest, **motivation/motives**, perceptions, reaction, recognition, reinforcement, sensation, and valence.*
Self development *20 areas*	*Adaptation to work, (re)adjustment, competency, concentration, confidence, **creativity**, ego development, independence, **locus of control**, mental health, mental imagery, personal growth, **proactivity**, readiness, **self-concept**, **self-efficacy**, **self-directedness/regulation**, **self-esteem**, **self-evaluation**, and spirituality.*
Value *13 areas*	*Accountability/responsibility, attributions, autonomy, belief, credibility/**trust**, dependability, **equity**, **fairness**, **loyalty**, **morality/morals**, **values**, willingness to help, and **work ethics.***
Group Level	
Affective team development *14 areas*	*Cohesiveness, compliance, conflict resolution (affective), **climate**, consensus, **cooperation**, **interpersonal skills**, **interaction**(affective), **group dynamics**(affective), **ownership**, **sharing** (open mind), **socialization**, **support**, and **work-life balance.***
Organizational Level	
Organizational behavior *12 areas*	*Attitude, efforts, **engagement**, exploratory behavior, **job/career satisfaction**, **job involvement**, **organizational commitment**, **organizational justice**, **organizational citizenship**, psychological contract, **psychological empowerment**, and risk-taking..*

* Bold-faced intervention areas indicate statistical significance for workplace performance outcomes in published journal articles.

"employee attachment-indicators of employee dedication, commitment, productivity and affective response to a company" create a competitive advantage (p. 89). In addition, organizations with high workplace spirituality showed increased efficiencies and productivity (Jurkiewicz & Giacalone, 2004). Trust had a positive influence on improving teamwork and cooperation in organizations (Williams, 2007). Moreover, psychological capital, such as hope, resilience, optimism, and self-efficacy, also had a positive relationship to performance (Luthans, Avolio, Avey, & Norman, 2007).

Recognition, achievement, possibility of growth, responsibility, and inter personal relations with a superior, subordinates, and peers were also positively related to employees' job attitudes (Herzberg, Mausner, & Snyderman, 1959). In the field of organizational behavior, perception, motivation, attitudes, beliefs, values, needs, and goals were strong determinants of individual performance (Arnold & Feldman, 1986; Schermerhorn, Hunt, & Osborn, 1998). Job satisfaction and organizational commitment have been key affective research topics in industrial and organizational psychology (Landy & Conte, 2009; Muchinsky, 2003). Recently, creativity, spirituality, and EI were found as influential toward job performance (Duchon & Plowman, 2005; Sy, Tram, & O'Hara, 2006). Scholars also reported that EI improved business performance in sales and manufacturing (Cherniss, 1999; Nafukho, 2009).

Some researchers went further to examine the positive influence of affective intervention areas on financial performance. Koys (2001) reported that employee satisfaction in one year had a positive influence on sales profitability in the following year due to its direct impact on customer satisfaction. Hansen and Wernerfelf (1989) explored the impact of organizational climate (including motivation, job satisfaction, and goal setting) on firm performance. They found that organizational climate explained twice as much of the variance in profit rates as did the economic factors.

One promising approach to measuring the impact of the affective domain is the Affective Event Theory (AET), which conceptualizes work events as proximal causes of affective and emotional reaction (Basch & Fisher, 2000; Weiss & Cropanzano, 1996). This framework posits that workplace and organizational events which generate positive affective responses over time influence workplace attitudes (e.g., job satisfaction, organizational trust, and commitment) and workplace behaviors (e.g., loyalty and productivity) (Weiss & Cropanzano, 1996).

Discussion and Implications

Few attempts have been made to explicitly discuss how intervention areas were utilized to facilitate the affective domain and how intervention areas of different kinds are compared as they affect organizational performances. In response, this study investigated how the affective domain has been defined in the literature, which taxonomies have been developed, and what kinds of intervention areas are common and what their impacts are in organizational contexts.

Although defining the affective domain has been regarded as difficult among researchers, our review and analysis of various definitions is unique, as we identified some common characteristics pertaining to the affective domain. One commonality of these various terms is that they are related to psychological and emotional aspects aiming to influence human experiences, learning behaviors,

and workplace performance. Another important point is that there exists a very strong relationship between cognition (thought) and affects (feeling) (Martin & Reigeluth, 1999).

To clarify whether a concept belongs to the affective domain, we proposed to examine whether included affective characteristics (a) are affected by an individual's beliefs, attitudes, and value, culture, and moral systems; (b) influence an individual's thinking processes and behaviors; (c) form attitudinal patterns; and (d) result in affective, cognitive, and behavioral outcomes, all within an organizational context.

From our review of existing taxonomies of the affective domain, it seems as if various components and elements representing the affective domain can be categorized into six areas based on their innate characteristics: (a) goal orientation, (b) self-concept, (c) personal attributes, (d) expressive state, (e) motivation, and (f) self-development. First, goal orientation involves those components leading individuals to an affective state and achieving affective outcomes through goals, values, beliefs, morality, and spirituality, which can be learned through social, religious, and educational systems. Second, self-conceptual elements include self-concept, self image, mental image, and self-esteem, which define how each individual views himself or herself. The self-conceptual elements are influenced and shaped by the goal-oriented elements. Third, the elements of personal attributes are personality, personal characteristics, and temperament, which are dispositional in nature. Fourth, the elements of an expressive state include positive and negative expressions of feelings, emotions, satisfactions, perceptions, and preferences. These elements are perceptual and emotional reactions toward certain mental, physiological, and psychological needs and stimuli. Fifth, motivational elements include components such as motives, drives, interests, and curiosity that lead to actions. Lastly, developmental elements include ego development, self-development, moral development, spiritual development, and locus of control. Past definitions and taxonomies of the affective domain addressed partial aspects of these six areas based on their respective purposes such as developmental, motivational, or goal-oriented rationales. The research studying the affective domain is criticized as being partial and not covering the wide range of affective elements. Adopting a more holistic approach to defining the domain (Callahan & McCollum, 2002) followed by clarifying targeted elements provides a clearer direction for future research on the affective domain.

In practice, the classification of affective intervention areas can be a useful tool to find appropriate solutions to improve individual and organizational performance. One can easily choose a relevant category from the classification of affective intervention areas and apply an appropriate affective strategy to address workplace performance issues. For example, in the context of goal achievement, receiving recognitions, and working with colleagues, affective intervention areas such as confidence, achievement motivation, and cooperation could be useful

to reinforce employees' positive emotional conditions (Basch & Fisher, 2000). If organizations expect that their employees display a professional commitment to improving customer service quality on a daily basis, their behaviors need to be persuasive, consistent, and predictable. In order to accelerate the internalization of desirable affective behaviors addressing this kind of issue, leaders, vocational educators, and HRD professionals need to provide appropriate feedback toward the employee's behaviors so that they can evaluate their current status and move forward toward a target goal.

Future Research and Limitations

Based on our review of previous taxonomy studies and additional review of affective intervention areas, we categorized the study variables and their resulting findings into three hierarchical levels (organizational, group, and individual) that can be utilized within organizational settings. One benefit of such classifications is to enhance understanding of the relationships among affective intervention areas in an organizational context. For example, emotion is "a response to an identified cause or target" (Grandey, 2009, p. 236), and "motivation affects choice, effort, and persistence" (Latham & Locke, 2009, p. 318) at the individual level. The emotion and motivation of individual employees can play an important role in group dynamics, interaction, engagement, and job satisfaction at the group and organizational level. As we pursue more research on these issues, classifications such as ours may help future research selectively target affective intervention areas at different levels and identify their impact on various workplace variables, such as organizational learning, work performance, employee morale, and job satisfaction. Future studies could also examine the interaction and relationships among the affective intervention areas. For instance, mood can influence individual risk-taking behaviors in the workplace (Mittal & Ross, 1998). Because organizational behaviors can be influenced by affect (Weiss & Cropanzano, 1996), the causal relationships and analysis of affective-driven behaviors are amenable to empirical analysis. Additionally, general characteristics such as personality and temperament, which we excluded in this study, can be conceptualized as input variables in affective research. There are several limitations to the current study. First, the data from three search engines and four academic journals may limit the generalization of the study results. Second, we experienced challenges in justifying the criteria for grouping, inclusion, and exclusion of affective interventions, especially for the category of self-development because of its extensive range. Luthan (2002) pointed out that state-like conditions are more amenable to interventions than traits, thus it would be useful to review the literature on positive personality states within the organizational behavior field and compare findings with dimensions of self development proposed by Brandhorst (1978) and Martin and Reigeluth (1999).

References

Angle, H. L., & Perry, J. L. (1981). An empirical assessment of organizational commitment and organizational effectiveness. *Administrative Science Quarterly, 26*(1), 1-14.

Ardichvili, A. (2008). Learning and knowledge sharing in virtual communities of practice: motivators, barriers, and enablers. *Advances in Developing Human Resources, 10*(4), 541-554.

Arnold, H. J., & Feldman, D. C. (1986). O*rganizational behavior.* New York: McGraw-Hill.

Ashkanasy, N. M., Härtel, C. E. J., & Zerbe, W. J. (2000). *Emotions in the workplace: Research, theory, and practice*. Westport, CT: Quorum Books.

Basch, J., & Fisher, C. D. (2000). Affective events-emotions matrix: A classification of work events and associated emotions. In N. M. Ashkanasy, C. E. J. Härtel, & W. J. Zerbe (Eds.), *Emotions in the workplace: Research, theory, and practice* (pp. 36-48). Westport, CT: Quorum Books.

Bills, R. E. (1976). Affect and its measurement. In W. Gephart, R. Ingle, & F. Marshall (Eds.), *Evaluation in the affective domain* (pp. 7-52). Bloomington, IN: Phi Delta Kappa.

Bloom, B. (1956). *Taxonomy of educational objectives: The cognitive domain*. New York: Donald McKay.

Bloom, B. S., Masia, B. B., & Krathwohl, D. R. (1964). *Taxonomy of educational objectives* (The affective domain & the cognitive domain). New York: David McKay.

Brandhorst, A. R. (1978). *Reconceptualising the affective domain.* (ERIC Document Reproduction Service No. ED 153891).

Brown, D. L., Ferrill, M. J., Hinton, A. B., & Shek, A. (2001). Self-directed professional development: The pursuit of affective learning. *American Journal of Pharmaceutical Education, 65*(3), 240-247.

Butler, R. C. (1972). *Instructional system development for vocational and technical training*. Englewood Cliffs, NJ: Educational Technology Publication.

Callahan, J. R., & McCollum, E. E. (2002). Conceptualizations of emotion research in organizational contexts. *Advances in Developing Human Resources, 4*(1), 4-21.

Cherniss, C. (1999). *The business case for emotional intelligence*. Graduate School of Applied and Professional Psychology, Rutgers University. Retrieved July 26, 2011, from http://www.eiconsortium.org/pdf/business_case_for_ei.pdf

Clayton, H. R., & Sankar, C. S. (2009). Using spreadsheets to enhance learning in the affective domain for undergraduate statistics students. *Transactions on Education, 10*(1), 10-17.

Cleveland-Innes, M., & Ally, M. (2004). Affective learning outcomes in workplace training: A test of synchronous vs. asynchronous online learning environments. *Canadian Journal of University Continuing Education, 30*(1), 15–35.

Collins, C. G., & Parker, S. K. (2010). Team capability beliefs over time: Distinguishing between team potency, team outcome efficacy, and team process efficacy. *Journal of Occupational and Organizational Psychology, 83*(4), 1003-1023.

Dettmer, P. (2006). New Blooms in established fields: Four domains of learning and doing. *Roeper Review*, *28*(2), 70-78.

Duchon, D., & Plowman, D. A. (2005). Nurturing the spirit at work: Impact on work unit performance. *Leadership Quarterly, 16*(5), 807-833.

Dumas, C. (1989). Understanding of father-daughter and father-son dyads in family-owned businesses. *Family Business Review, 2*(1), 31-46.

Fagerstrøm, A. (2010). The motivating effect of antecedent stimuli on the web shop: A conjoint analysis of the impact of antecedent stimuli at the point of online purchase. *Journal of Organizational Behavior Management, 3*0(2), 199-220.

Fertig, J., Zeitz, G., & Blau, G. (2009). Building internal motivation for worker competency Certifications: A critique and proposal. *Human Resource Development Review, 8*(2), 197-222.

Fredrickson, B. L. (2003). Positive emotions and upward spirals in organizations. In K. S. Ameron, J. E. Dutton, & R. E. Quinn (Eds.), *Positive organizational scholarship* (pp. 163-175). San Francisco: Berrett-Koehler.

Gagné, R. M. (1984). Learning outcomes and their effects: Useful categories of human performance. *American Psychologist*, *39*(4), 377-385.

Gallagher, S. J., Rocco, T. S., & Landorf, H. (2007). A phenomenological study of spirituality and learning processes at work: Exploring the holistic theory of knowledge and learning. *Human Resource Development Quarterly, 18*(4), 457-480.

Garber, P. W. (1996). The relations of emotional role taking, affective/moral attributions, and emotional display rule knowledge to low-income school-age children's social competence. *Journal of Applied Developmental Psychology, 17*(1), 19-36.

Gephart, W. J., & Ingle, R. B. (1976). *Evaluation and the affective domain*. Proceedings of the National Symposium for Professors of Educational Research (NSPER). (ERIC Document Reproduction Service No. ED 157911).

Grandey, A. A. (2009). Emotions at work: A review and research agenda. In J. Barling, & C. L. Cooper (Eds.), *The Sage handbook of organizational behavior* (Vol. 1, pp. 236–261). Thousand Oaks, CA: Sage Publications.

Griffitt, W. (1970). Environmental effects on interpersonal affective behavior: Ambient effective temperature and attraction. *Journal of Personality and Social Psychology, 15*(3), 240-244.

Hansen, G. S., & Wernerfelf, B. (1989). Determinants of firm performance: The relative importance of economic and organizational factors. *Strategic Management Journal, 10*(5), 399-411.

Hattie, J., Biggs, J., & Purdie, N. (1996). Effects of learning skills interventions on student learning: A meta-analysis. *Review of Educational Research, 66*(2), 99-136.

Hempel, P. S., Zhang, Z., & Tjosvold, D. (2009). Conflict management between and within teams for trusting relationships and performance in China. *Journal of Organizational Behavior, 30*(1), 41-65.

Herzberg, F., Mausner, B., & Snyderman, B. (1959). *The motivation to work*. New York: John Wiley & Sons.

Himsl, R., & Lambert, E. (1993). Signs of learning in the affective domain. *Alberta Journal of Educational Research, 39*(2), 257-273.

Hirt, E. R., Levine, G. M., McDonald, H. E., & Melton, R. J. (1997). The role of mood in quantitative and qualitative aspects of performance: Single or multiple mechanisms? *Journal of Experimental Social Psychology*, *33*(6), 602–629.

Hoepfner, R. (1972). *CSE-RBS test evaluations: Tests of higher-order cognitive, affective, and interpersonal skills*. (ERIC Document Reproduction Service No. ED076713).

Horne, S. E. (1980). Behavioural objectives in the affective domain: A new model. *British Educational Research Journal, 6*(2), 189-196.

Hughes, C. (2010). "People as technology" conceptual model: Toward a new value creation paradigm for strategic human resource development. *Human Resource Development Review, 9*(1), 48-71.

Jalajas, D. S, & Bomme, M. (1999). The influence of job motivation versus downsizing on individual behavior. *Human Resource Development Quarterly, 10*(4), 329-344.

Jordan, P. J., & Troth, A. C. (2002). Managing emotions during team problem solving: Emotional intelligence and conflict resolution. *Human Performance, 17*(2), 195-218.

Jurkiewicz, C. L., & Giacalone, R. A. (2004). A values framework for measuring the impact of workplace spirituality on organizational performance. *Journal of Business Ethics, 49*(2), 129-142.

Koys, D. L. (2001). The effects of employee satisfaction, organizational citizenship behavior, and turnover on organizational effectiveness: A unit-level, longitudinal study. *Personnel Psychology, 54*(1), 101-114.

Kozlowski, S. W. J., & Bell, B. S. (2008). Team learning, development, and adaptation. In

W. I. Sessa, & M. London (Eds.), *Work group learning: Understanding, improving and assessing how groups learn in organizations* (pp. 15-44). New York: Lawrence Erlbaum Associates.

Kraiger, K., Ford, J. K., & Salas, E. (1993). Application of cognitive, skill-based, and affective theories of learning outcomes to new methods of training evaluation. *Journal of Applied Psychology*, *78*(2), 311-328.

Krathwohl, D. R., Bloom, B. S., & Masia, B. B. (1964). *Taxonomy of educational objectives: The classification of educational goals. Handbook II: Affective domain.* New York: Longman.

Laforgia, J. (1988). The affective domain related to science education and its evaluation. *Science Education, 72*(4), 407–421.

Lambert, E., & Himsl, R. (1993). *Signs of learning in an affective domain*. Edmonton, CA: Alberta Department of Education.

Landy, F. J., & Conte, J. M. (2009). *Work in the 21st century: An introduction of industrial and organizational psychology* (3rd ed). Hoboken, NJ: Wiley-Blackwell.

Latham, G. P., & Locke, E. A. (2009). Employee motivation. In J. Barling, & C. L. Cooper (Eds.), *The Sage handbook of organizational behavior* (Vol. 1, pp. 318–333). Thousand Oaks, CA: Sage Publications.

Lewalter, D., & Krapp, A. (2004). The role of contextual conditions of vocational education for motivational orientations and emotional experiences. *European Psychologist, 9*(4), 210-221.

Lewis, C., Watson, M., & Schaps, E. (1999). Recapturing education's full mission: Educating for social, ethical, and intellectual development. In C. M. Reigeluth (Ed.), *Instructional-design theories and models,: A new paradigm of instructional theory* (Vol. 2, pp. 511-536). Mahwah, NJ: Lawrence Erlbaum Associates.

Lipponen, J., & Wisse, B. (2010). Shared perceptions of perceived justice as a predictor of externally rated departmental level academic performance. *Journal of Occupational and Organizational Psychology, 83*(4), 1065-1074.

Luthans, F. (2002). The need for and meaning of positive organizational behavior. *Journal of Organizational Behavior, 23*(6), 695–706.

Luthans, F., Avolio, B. J., Avey, J. B., & Norman, S. M. (2007). Positive psychological capital: Measurement and relationship with performance and satisfaction. *Personnel Psychology, 60*(3), 541-572.

Lynch, D. R., Russell, J. S., Evans, J. C., & Sutterer, K. G. (2009). Beyond the cognitive: The affective domain, values, and the achievement of the vision. *Journal of Professional Issues in Engineering Education and Practice, 135*(1), 47-56.

Martin, B. L., & Briggs, L. J. (1986). *The affective and cognitive domains: Integration for instruction and research*. Englewood Cliffs, NJ: Educational Technology Publications.

Martin, B. L., & Reigeluth, C. M. (1999). Affective education and the affective domain: Implications for instructional-design. In C. M. Reigeluth (Ed.), *Instructional-design Theories and Models: A new paradigm of instructional theory* (pp. 485-510). Hillsdale, NJ: Lawrence Erlbaum Associates.

Maatman, M., Bondarouk, T., & Looise, J. K. (2010). Conceptualising the capabilities and value creation of HRM shared service models. *Human Resource Management Review, 20*(4), 327-339.

McLeod, D. B. (1988). Affective issues in mathematical problem solving: Some theoretical considerations. *Journal for Research in Mathematics Education, 19*(2), 134-141.

Meyer, J. P., & Allen, N. (1991). A three-component conceptualization of organizational commitment. *Human Resource Management Review, 1*(1), 61-89.

Mittal, V., & Ross, W. T. (1998). The impact of positive and negative affect and issue framining on issue interpretation and risk taking. *Organizational Behavior and Human Decision Process, 76*(3), 298-324.

Muchinsky, P. M. (2003). *Psychology applied to work* (7th ed.). Belmont, CA: Wadsworth/Thomson Learning.

Nafukho, F. M. (2009). Emotional intelligence and performance: Need for additional empirical evidence. *Advances in Developing Human Resources, 11*(6), 671-689.

Nahl, D., & Bilal, D. (2007). *Information and emotion: The emergent affective paradigm in information behavior research and theory*. Medford, NJ: Information Today.

Nolan, K. P., & Harold, C. M. (2010). Fit with what? The influence of multiple self-concept images on organizational attraction. *Journal of Occupational and Organizational Psychology, 83*(3), 645-662.

Nussbaum, J. F. (1983). Relational closeness of elderly interaction: Implications for life satisfaction. *Western Journal of Speech Communication, 47*(3), 229-243.

Peterson, C., & Seligman, M. (2004*). Character strengths and virtues: A handbook and classification*. New York: Oxford University Press.

Potosky, D. (2010). Goal orientation, learning self-efficacy, and climate perceptions in a post-acquisition corporate context. *Human Resource Development Quarterly, 21*(3), 273–289.

Powell, D. W., & Meyer, J. P. (2004). Side-bet theory and the three-component model of organizational commitment. *Journal of Vocational Behavior, 65*(1), 157-177.

Ringness, T. A. (1975). *The affective domain in education*. Boston, MA: Little, Brown & Company.

Russell, M. (2004).The importance of the affective domain in further education classroom culture. *Research in Post-Compulsory Education, 9*(2), 249-270.

Sadler, T. D., & Zeidler, D. L. (2005). Patterns of informal reasoning in the context of socioscientific decision-making. *Journal of Research in Science Teaching, 42*(1), 112–138.

Savicki, V. (2008). *Developing intercultural competence and transformation: Theory, research, and application in international education*. Sterling, VA: Stylus Pub.

Schermerhorn, Jr., J. R., Hunt, J. G., & Osborn, R. N. (1998). *Basic organizational behavior* (2nd ed). New York: John Wiley & Sons.

Scott, K. L., Shaw, J. D., & Duffy, M. K. (2008). Merit pay raises and organization-based self-esteem. *Journal of Organizational Behavior, 29*(7), 967-980.

Shuck, B., & Wollard, K. (2010). Employee engagement and HRD: A seminal review of the foundations. *Human Resource Development Review, 9*(1), 89-110.

Sinclair, K. E. (1985). Students' affective characteristics and classroom behavior. In T. Husen, & T. N. Postlethwaite (eds.), *The international encyclopedia of education* (Vol. 8, pp. 4881-4886). Oxford, England: Pergamon Press.

Snow, R. (1989). Aptitude-treatment interaction as a framework for research on individual differences in learning. In P. Ackerman, R. Sternberg, & R. Glaser (Eds.), *Learning and individual differences* (pp. 13-60). New York: Freeman.

Stevens, C. K., & Gist, M. E. (1997). Effects of self-efficacy and goal orientation on negotiation skill maintenance: What are the mechanisms? *Personnel Psychology, 50*(4), 955–978.

Sy, T., Tram, S., & O'Hara, L. A. (2006). Relation of employee and manager emotional intelligence to job satisfaction and performance. *Journal of Vocational Behavior, 68*(3), 461-473.

Torraco, R. J. (2005). Writing integrative literature reviews: Guidelines and examples. *Human Resource Development Review, 4*(3), 356-367.

Ulrich, D., Halboork, R., Meder, D., Stuchlik, M., & Thorpe, S. (1991). Employee and customer attachment: Synergies for competitive advantages. *Human Resource Planning, 14*, 89-103.

Vince, R. (2002). Organizing reflection. *Management Learning, 33*(1), 63-78.

Weinberger, L. A. (2009). Emotional intelligence, leadership style, and perceived leadership effectiveness. *Advances in Developing Human Resources, 11*(6), 747-773.

Weiss, H. M., & Cropanzano, R. (1996). Affective events theory: A theoretical discussion of the structure, causes and consequences of affective experiences at work. In R. I. Sutton & B. M. Staw (Eds.), *Research in organizational behavior* (pp. 1–74). Greenwich, CT: JAI Press.

Williams, M. (2007). Building genuine trust through interpersonal emotion management: A threat regulation model of trust and collaboration across boundaries. *Academy of Management Review, 32*(2), 595-621.

Zytowski, D. G. (1994). A super contribution to vocational theory: Work values. *Career Development Quarterly*. *43*(1), 25-31.

Consequences of Employee Turnover in the Banking Industry: A Review of Selected Literature

Dan Obiero, Fredrick M. Nafukho, and Homer Tolson
Texas A&M University

Abstract

Understanding employee turnover behaviors is critical in planning and improving human capital capacities in organizations. This review of selected literature on the antecedents and consequences of turnover focuses on the banking sector, an industry that intermediates activities in other sectors. The review summarizes the major antecedents of turnover as being the economic state of the national economy, the job satisfaction, employee training and development, and earnings. The consequences arising from turnover include reduced employee productivity, lost training and skills set, low commitment to the organization, and a high cost of replacement of separated staff. Results of the review show that turnover is expensive and has a negative impact on the organizations' performance.
Keywords: banking industry, human capital, organizational performance, turnover, talent management, organizational development

Introduction

Banks like all other organizations depend on human capital to achieve their mission and goals. Human capital is the "knowledge, expertise and skills that one accumulates through education and training" (Swanson & Holton, 2001, p. 109). It is the most important resource in sustaining competitive advantage and performance (Hitt & Ireland, 2002). Organizations invest more than one third of their earnings in human capital, but few can account for this investment (Nalbantian & Szostak, 2004). Antonacopoulou (2006) noted, "banks realize that it is necessary to develop policies that will ensure that once skilled people are in position; they are retained … " (p. 458). The negative impact of employee instability in banks is well known to the executives of banks, such as Commerce Bank and Wells Fargo (Hall, 2007).

Turnover refers to the number of people who leave employment, or an organization (DeNisi & Griffin, 2008). Cascio and Boudreau (2008) looked at turnover in terms of not only the separation, but also replacement of employees. There are two types of turnover: voluntary and involuntary. Voluntary turnover is when an employee separates from an organization out of his or her own initiative. It includes employees who leave to seek better employment opportunities, work conditions and rewards, early retirement, changing careers, or even moving families. When organizations loss employees they need and cannot avoid or control the separation, it is unfavorable and dysfunctional to the organization (Dalton, Todor, & Krackhardt, 1982). Involuntary turnover is when the organization initiates the separation process (Campion, 1991). HRD professionals are challenged to think of new ways of measuring knowledge assets in organizations, and especially during financial meltdown and instability, as this is a necessary condition to ensure sustained growth (Nafukho, 2009).

Statement of Problem and Purpose of Study

Banks "not only influence the economic, political, and socio-cultural context in which they operate; they also affect it" (Antonacopoulou, 2006, p. 458). Turnover has been found to create inefficiencies that in turn, affect organizational performance (Morrow & McElroy, 2007). Nalbantian and Szostak (2004) noted that ignoring employee turnover, led to more separations, and placed the U.S. Fleet bank's customer focused strategy at risk. Grunwald (2009) stated, "major financial crises cost nations between 5% and 20% of their national output" (p. 60). A problem in one banking group may have contagion effects in other banks and therefore bank performance stability is important (Caprio & Klingebiel, 1997). Turnover can be expensive to institutions and it should be reduced (Autry & Daugherty, 2003).

The purpose of this paper was to identify the main antecedents and consequences of employee turnover in the banking industry and to bring to the attention of the management, and HRD practitioners, the phenomenon of employee turnover and how it affects the performance of the banking industry. The study addressed three questions: 1) What are the main reasons for employee turnover? 2) What are the consequences of turnover on organizational performance? 3) How can the financial cost of separations be estimated?

Significance of the Study

The findings of this study sensitize the bank executives' and managers on the effects and impact of turnover on institutional performance. The findings should help banks to classify turnover by avoidability and functionality and be able to

work out the financial cost of turnover to the organizations. This information is important for personnel training and development, organizational development, employee succession planning, and talent management and development. Strategic management of the high value pivotal talent pools is important to organizations (Cascio & Boudreau, 2008). Scholars in HRD with interest in turnover should find this review useful in conducting further studies.

Method

The literature was accessed from various databases, such as PRO QUEST, EBSCO, ERIC, and other reference books and materials relevant to the subject of turnover. Key words used in the search were: "turnover", "banking industry and turnover", "knowledge assets", "human capital", "training and development", and "performance and turnover".

Theoretical Framework

This literature review's theoretical framework is grounded in two viewpoints on turnover theory those of March and Simon (1958) the "decision to participate theory" and Barnard's (1938) "inducement – contribution equilibrium theory". Over time, turnover theories have evolved, and currently, multiple perspectives and causes of turnover are being addressed as explained in the study on turnover and co-worker contagion effects by Felps, Mitchell, Hekman, Lee, Holton, and Harman (2009). However, as noted by Lee and Mitchell (1994) "unquestionably, the dominant paradigm on turnover originates from March and Simon's (1958) decision to participate" (p. 96). The decision to participate theory is related to the inducement-contribution equilibrium theory propounded by Barnard (1938), but has important extensions that participants have to stay motivated to participate. The participation continues as long as the utility from inducements are higher than contributions. The employee's utility or satisfaction is based on the salary, the job being in conformity with the person's image, the predictability of the major job relationships, and compatibility with the job and work roles.

The theory of met expectations states that, if employees' expectations in work environment, job content, and pay are clear at the beginning of the engagement and met on employment, they were likely to stay on (Porter & Steers (1973). According to this theory, felt high pay, participation in primary groups that increase the feeling of cohesion and belonging, high amounts of communication, and less centralization of authority in an organization will reduce turnover (Price (1975). The met expectations theory was further by developed by Mobley's (1977) model that allowed for multiple evaluation of how psychological and economic reasons affected employee turnover.

The "unfolding model of employee turnover" propounded by Lee and Mitchell (1994), explained turnover from the construct of how well one was fitting in an organization, considering the job involvement, values and goals. Mitchell, Holton, Lee, Sablynski and Erez (2001) introduced the construct of *Job embeddedness* to understanding voluntary employee turnover. This was the link between the people in organizations, how well they fit into the jobs they do and the community they work in, and what they would have to sacrifice to quit the jobs.

Felps et al. (2009) showed that turnover can be better explained by the job embeddedness and coworkers' contagion effects. They noted that with workers embedded in their jobs, organization, and society, the turnover is lower. And that embedded workers influence their coworkers to stay in the organization. When embedded workers quit, they also influence their co-workers to quit.

Cascio and Boudreau (2008) calculate turnover rates as; number of turnover incidents per period divided by the average workforce size in the year and multiplied by one hundred. Campion (1991), notes that turnover can be measured based on turnover reasons, avoidability, functionality, voluntariness and utility. Turnover can be avoidable or unavoidable depending on the circumstances compelling it (Campion, 1991). Avoidable turnover is when an institution can take some action that leads to employees not to separate from the institution. Unavoidable turnover is when an institution can do nothing to avoid the turnover. In this case it is unfavorable since the institution still needs the services of the employee but it cannot meet his or her wants (Abelson, 1987).

Turnover can be functional or dysfunctional, Abelson and Baysinger (1984), Dalton, Krackhardt, and Porter (1981), Dalton, Todor, and Krackhardt (1982), and Hollenbeck and Williams (1986), looked at functionality by the organization's evaluation of the individual. The loss of an employee who is a good performer and difficult to replace is dysfunctional and bad for the organization. Turnover among experienced workers disrupts provision of service values and norms to new staff, essential for continuity in providing high quality service (Schlesinger & Heskett, 1991).

According to Boudreau and Berger (1985), organizations can measure turnover by its utility. The utility analysis is done in terms of the productivity or utility of the new employee, in comparison to the utility of the person they are replacing. The utility measure is the cost difference between the separating employee and the new hire, based on the salary and benefits, the cost of transactions in processing the termination, and hiring the new employee. Turnover is good if the organization is getting a better performer at a lower pay and cost to the institution, which is higher utility.

This literature review works from the theoretical framework that institutions will have to look for the balance between the contributions and rewards extended to employees to retain the valued human resources in organizations.

Human capital is a valuable resource in organizational performance (DeNisi & Griffin, 2008; Marshal, 1949), and retention is a significant consideration in attaining the competitive advantage in the business as separations come with inherent costs to the organizations. Organizations that invest, use, and suitably reward human capital, eventually experience higher performance (Hitt & Ireland, 2002).

Antecedents of Turnover

Reasons for turnover in organizations include; the state of the national economy, institutional factors, and individual variables that are work and non-work related (Mobley, 1982). To manage turnover, organizations must understand why employees leave.

Economic Environment

According to DeNisi and Griffin (2008), when the economy is doing well the voluntary turnover is expected to be high. March and Simon (1958) stated, "the most accurate single predictor of labor turnover is the state of the economy (p.100)". When the economy is doing well and jobs are plenty, voluntary turnover is high. However, March and Simon (1958) refined the proposition to note that, the activity in a particular sector of the economy may influence the turnover level, despite the status of the overall national economy. The U.S. economy, for example, was in a recession (2008-2010); the Bureau of Labor statistics reported loss in millions of jobs (U.S. Bureau of Labor, 2010). The Federal Deposit Insurance Corporation reported that 140 banks failed in 2009 alone and many businesses declared bankruptcies.

Job Satisfaction

Job satisfaction is the employees' cognitive view of the job they are doing, it may be favorable or unfavorable (Jex & Britt, 2008). Factors affecting job satisfaction include; job responsibilities and scope, salary, seniority, and size of organization, which influence employee turnover (DeNisi & Griffin, 2008; Judge & Bono, 2001). Dissatisfied and uncommitted employees may stay on-the-job just to earn a salary (Jex & Britt, 2008) and research has shown there is a consistent positive relationship between job satisfaction and voluntary turnover in organizations (Felps et al., 2009).

Employees are unlikely to leave an organization if their work is recognized and feedback given to appreciate their work (Muchinsky & Morrow, 1980). Carson, Carson, Griffeth, and Steel (1994) noted that, when employees are pro-

moted, which is recognition of performance, their motivation and job satisfaction increase and they are unlikely to leave an organization. Employees who have managers with good human relations and leadership qualities are less likely to quit as this is an indication of a healthy work environment (Dodd, 2001).

Training

Organizations that train, and reward employees well will keep them, and get higher performance in return (Hitt & Ireland, 2002). Training and development opportunities provided by organizations lead to staff commitment and reduce turnover because the employees feel the organization cares for them and thus they respond by staying on and performing better (Martin, 2003). According to Taylor (1999) employees get more committed to organizations that help them upgrade their skills, become more marketable and develop a career. Providing effective training and setting explicit expectations help reduce turnover (Hollis, 2003).

Earnings

Turnover research has showed that there is a strong relationship between pay and the rate of turnover (Grifffeth, Hom & Gaertner, 2001). The more one earns in salary and benefits, comparable to earnings in similar jobs in the industry, and job requirements, the lower the chances of leaving. Employee earnings and other monetary incentives play a major role in retention (Morice &Murray, 2003). Low pay and benefits in some staff categories, especially bank tellers have led to turnover rates of about 30 % in small and medium size U.S. banks (Matthew, 2005).

Demographics

Age and tenure are inversely related to turnover, younger employees are likely to change jobs more often (Muchinsky & Morrow, 1980). According to Mobley, Griffeth, Hand and Meglino (1979), the longer a person stays at an organization the lower the chances of leaving. The longer people stay in an organization and get more embedded, the less the turnover rate (Mitchell et al., 2001).

Consequences of Turnover

Turnover has economic, social and psychological effects in organizations (Felps et al., 2009). The economic effect is estimated by the financial impact of separation. The psychological effects focus on the behavior of both the sepa-

rating and staying employees. While sociological effects relates to how it affects institutional changes within and across the industries. Turnover actions have negative impact on organizations (Felps et al., 2009; Jex & Britt, 2008).

Organization Culture and Integration

High amount of turnover leads to low integration in organizations or participation in the primary groups, as the remaining members of the organization feel a loss of one of their own (Price, 1975). When an embedded employee quits, this action affects other colleagues through the social contagion effects and the results are that other employees are likely to follow and leave the organization (Felps, et al., 2009). Mathew (2005) reported that high turnover at the Fleet Bank, was one reason for the bank's poor consumer rating in the mid to late 1990s, and this negatively affected its business. Fleet Bank, then the nation's seventh largest financial holding, had not given attention to the continuing high rate of turnover, this led to employee separations and placed the bank's customer focused strategy at risk (Nalbantian & Szostak, 2004).

In cases where the separating employee is forced out because of conflicts, the colleagues remaining in the organization view themselves as less desirable, and have lower morale, and this may trigger more turnovers (Felps et al., 2009; Staw, 1980;). Schneider and Bowen (1985) found that bank branch customer attitudes about service quality were strongly related to employees' views of service provision, if workers leave or are not satisfied, then customers get dissatisfied. Loss of customers has the ripple effects of loss of business and overall profitability of the bank branch. Departures of embedded employees should be strategically handled to ensure that work, and productivity is not affected (Crossley, Bennet, Jex & Burnfield, 2007).

Staffing

Turnover may create greater flexibility in staffing as chances of promotions are created especially in organizations that have a good internal succession plan; one management exit opens opportunity for multiple promotions from lower levels. Availing promotion opportunities to staff make them stay longer (Nalbantian & Szostak, 2004; Spector, 2006). This may also lead to cost saving for the organization as it may not need to hire, but promote from lower ranks (Staw, 1980).

The benefits of turnover to existing staff works from the presumption that there are employees with the relevant skills within the organization, and are available to take up the responsibilities with minimal disruptions. Where such expertise is lacking turnover triggers a disruption in performance. The organization will have to take time to hire competent replacements who may take

time to learn and settle on-the-job (Jex & Britt, 2008). The hired people need to socialize, learn the organization culture, and job to reach the desired competence (Chao, O'Leary- Kelly, Wolf, Klein & Gardner, 1994).

Banking is a specialized sector that relies on skilled labor and therefore turnover in the banking industry can be viewed as a systemic performance problem. Organizations with high rates of turnover have been noted to perform at lower output levels compared to their rivals in the same industry (Hatch & Dyer, 2004). Strategic management of high value pivotal talent pools is important to organizations performance (Cascio & Boudreau, 2008).

Replacement Cost

Cascio (2006) estimates employee separation cost at between 150% and 250% of the annual salary paid for the job. Bliss (2004) estimates the cost of turnover to organizations to be about 150% of the annual pay. With departure of employees, organizations incur costs that can be large depending on the positions being filled. This is considering the cost of separation, replacement and training the new hire. Creery (1986) observed that the turnover rate of bank tellers in the U.S. was between 25% and 30%, and cost between $20,000 and $25,000 per year, per separated employee. This was about ten times more, than Mirvis and Lawler (1977) estimated it to be. Most of these costs were noted to be indirect costs such as lost or dissatisfied customers, frauds, cashiers shortages, legal expenses, charged-off loans and security costs that arise because of the departure of employees. Banks need well trained employees and the cost of hiring and keeping them is high (Creery, 1986).

Training and Development Cost

Training cost is a major factor that comes with turnover in organizations since the newly employed workers have to be inducted into the new employment and trained to deliver to the performance standard of the separated employees. Even when employees are promoted from within the organization, there is need to train the people taking over the new responsibilities, and this takes money and time (Bluedorn, 1982). The training costs include orientation, formal workshop training, and valuing the time taken by the supervisors and managers to bring the new person up to the required task level (Cascio & Boudreau, 2008).

Productivity

Employee turnover leads to depletion of organizations' inventory of skills, and forces them to hire replacements to sustain productivity (Jix & Britt, 2008).

When new hires join organizations, it takes them time to learn and perform tasks to the desired productivity. There is empirical evidence that, even good workers experience a drop in the level of job performance following employment (Boswell, Shipp, Payne, & Culberston, 2009). This implies that, the productivity of the organization will reduce upon arrival of new hires. According to Cascio (2006), the reduced new hire productivity, is the highest cost of turnover to organizations. New employees, other than producing at level below the required productivity, draw full salaries from the organizations, thus being a double liability to organizations in the short run (Jex & Britt, 2008).

Morrow and McElroy (2007) in their study of turnover and performance in a banking institution found that turnover creates inefficiencies that in turn, affect organizational performance. Turnover among experienced staff disrupts essential service provision needed for business continuity, as new employees may also bring with them baggage or job attitudes that negatively impact the organizations (Boswel et al., 2009).

Employee turnover negatively impact organizations in several ways. The organizational culture and norms are disrupted, and this impacts the worker's productivity as the climate in the organization is readjusted. The organization is forced to incur added staff training and development costs to replace the separated employees. The organizations pay for less productive workers for a period of time, as the new hires undergo orientation and training. Table 1 shows the key theories pertaining to the phenomenon of turnover in organizations.

Table 1
Turnover Theories from the Selected Literature

Author	Theory	Antecedents	Consequences	Empirical support
Barnard (1938)	Inducement-Contribution	• Salary levels/ Inducements • Participation in groups / close socialization with coworkers	• Low productivity of dissatisfied workers	None
March and Simon (1958)	Decision to participate	• Salary levels/ Inducements • State of economy • Demographics • Availability of suitable jobs	• Low productivity of dissatisfied workers • Low employee motivation • Turnover and related costs	Yes
Porter and Steers (1973)	Met Expectations	Failed promises on • Salary level • Job content • Job responsibility • Training and development	• Low productivity of dissatisfied workers waiting to leave • Turnover and related costs	Yes

Author	Theory	Antecedents	Consequences	Empirical support
Price (1975)	Combination of four factors: pay, cohesion, communication, and authority	• High pay • Socialization • Central authority • High org communications	▪ Weak cooperate culture ▪ Low productivity of dissatisfied workers waiting to leave ▪ Turnover related costs	Yes
Mobley (1977)	Multiple evaluation of Economic and psychological reasons	▪ Salary levels/ Inducements ▪ Close socialization ▪ Availability of suitable jobs ▪ Training and development	▪ Turnover related costs of separation, ▪ hiring ▪ training ▪ Non-productive workers on payroll waiting to exit ▪ Absenteeism, deviant behavior	Yes

Conclusion

Employee turnover affects the inventory of skills an organization holds, and therefore understanding turnover and having a strategic plan to handle turnover issues is important in planning, training and development of personnel. Turnover also affects employee motivation and commitment to organizations; these are considerations critical for effective employee performance. The reputational costs due to workers and customer withdrawal can lead to bank failure and this may have contagion effect in the economy. Deviant behaviors in banks may lead to increased frauds and legal issues, increased non-performing loans, and a significant reputational impact.

Turnover has cost implications especially in terms of worker productivity as it depletes the skills set within an organization. Understanding the reasons that cause or influence employees to leave or stay in organizations, to uphold productivity, are undoubtedly important. For specialized sectors like banking that have impact on other sectors it is important to keep turnover low.

The factors to be taken into account in estimating the cost of turnover are indicated in the this paper and bank management should be guided by the same in estimating the financial impact of turnover to the organization, this may be substantial and a loss to the investing stakeholders who aim to maximize returns on their investments. The consequences of turnover have implications for training and development of personnel in banks, performance at individual, process, and organization levels.

References

Abelson, M. A. (1987). Examination of avoidable and unavoidable turnover. *Journal of Applied Psychology, 72,* 382–6. doi:10.1037/0021-9010.72.3.382

Abelson, M. A., & Baysinger, B. D. (1984). Optimal and dysfunctional turnover: Toward an organization level model. *Academy of Management Review, 9*(2), 331-341. Retrieved from http://www.jstor.org/stable/258446

Antonacopoulou, E. L. (2006). The relationship between individual and organization learning: New evidence from managerial learning practices. *Management Learning, 37*(4), 455-473.doi: 10.1177/1350507606070220

Autry, C. W., & Daugherty, P. J. (2003). Warehouse operations: Linking personal-organization fit, job satisfaction, and coping responses. *Journal of Business Logistics, 24*(1), 171-197.

Barnard, C. (1938). *The functions of the executive*. Cambridge, MA: Harvard.

Bliss, G. (2004). Cost of employee turnover. Retrieved from http://www.atstrain.com/research

Bluedorn, A. C. (1982, April). Managing turnover strategically. *Business Horizons,25, 6-12.*

Boswell, W. R., Shipp, A. J., Payne, S. C., & Culberston, S. S. (2009). Changes in new comer job satisfaction over time: Examining the pattern of honeymoons & hangovers. *Journal of Applied Psychology, 94*(4), 844-858. doi:10.1037/a0014975

Boudreaux J. W., & Berger, C. J. (1985). Decision –Theoretic utility analysis, applied to employee separations and acquisitions. *Journal of Applied Psychology, 70*(3), 581-612. doi:10.1037/0021-9010.70.3.581

Campion, M.A. (1991). Meaning and measurement of turnover: Comparison of alternative measures and recommendations for research. *Journal of Applied Psychology, 76*(2), 199-122.doi: 10.1037/0021-9010.76.2.199

Caprio Jr, G., & Klingebiel, D. (1997). Bank insolvency: Bad luck, bad policy, or bad banking? *Annual World Bank Conference on Development Economics, 1996.*

Carson, P. P., Carson, K. D., Griffeth, R. W., & Steel, R. P. (1994). Promotion and employee turnover: Critique, meta-analysis, and implications. *Journal of Business and Psychology, 8(*4), 455-465.

Cascio, W. F. (2000). *Costing human resources: The financial impact of behavior in organizations* (4th ed.). Boston, MA: Kent.

Cascio, W. F. (2006). The economic impact of employee behaviors on organizational performance. *California Management Review, 48*(4), 41-59.

Cascio, W. F., & Boudreau, J. W. (2008). *Investing in people: Financial impact of human resources initiatives.* Upper Saddle River, NJ: Pearson Education.

Chao, G. T., O'Leary-Kelly, A. M., Wolf, S., Klein, H. J., & Gardner, P. D. (1994). Organizational socialization: Its contents and consequences. *Journal of Applied Psychology, 79, 730-*749.

Creery, P. T. (1986, Sept.). The high cost of turnover. *ABA Banking Journal*, 78(9), 113-114.

Crossley, C. D., Bennett, R. J., Jex, S. M., & Burnfield, J. L. (2007). Development of a global measure of job embeddedness and integration into a traditional model of voluntary turnover. *Journal of Applied Psychology,* 92, 1031–1042.

Dalton, D. R., Todor, W. D., & Krackhardt, D. M. (1982). Turnover overstated: The functional Taxonomy. *Academy of Management Review, 17*(1), 117-123. Retrieved from http://www.jstor.org/stable/257256

Dalton, D. R., Krackhardt, D. M., & Porter, L.W. (1981). Functional turnover: An empirical assessment. *Journal of Applied Psychology, 66*(6), 716-721. doi: 10.1037/0021-9010.66.6.716

DeNisi, A. S., & Griffin, R. W. (2008). *Human resource management* (3rd ed.). Boston, MA: Houghton Mifflin.

Dodd, K. (2001). Knowing how to keep your best and brightest. *Workforce 80*(4), 57-60.

Federal Deposit Insurance Corporation. (2010). Failed bank list. Retrieved from: http://www.fdic.gov/bank/individual/failed/banklist

Felps, W., Mitchell, T. R., Hekman, D. R. Lee, T .W. Holtom, B.C., Harman, W.S. (2009). Turnover Contagion: How coworkers' job embeddedness and job search behaviors influence quitting. *Academy of Management Journal, 52*(3), 545–561.

Griffeth, R. W., Hom, P. W., & Gaertner, S. (2000). A meta-analysis of antecedents and correlates of employee turnover: Update, moderator tests, and research implications for the next millennium. *Journal of Management, 26*(3), 463-488.

Grunwald, M. (2009, Dec.). Person of the year: Ben Bernanke. *Time Magazine*, 44-78

Hall, R. (2007). The Cost of Divorce--Business Style. *ABA Bank Marketing*, 16-17.

Hatch, N. W., & Dyer, J. H. (2004). Human capital and learning as a source of substantial competitive advantage. *Strategic Management Journal, 25,* 1155-1178.

Hitt, M. A., & Ireland, R. D. (2002). The essence of strategic leadership: Managing human and social capital. *Journal of Leadership and Organizational Studies, 9*(1), 3-14. doi: 10.1177/107179190200900101

Hollenbeck, J. R., & Williams, C .R. (1986). Turnover functionality versus turnover frequency: A note on work attitudes and organizational effectiveness. *Journal of Applied Psychology, 71,* 606-611. doi: 10.1037/0021-9010.71.4.606

Jex, S. M., & Britt, T. W. (2008). *Organizational Psychology: A scientist- practitioner approach*. Hoboken, NJ: Wiley.

Judge, T. A., & Bono, J. E. (2001). Relationship of core self evaluation traits, self esteem, generalized self-efficacy, locus of control, and emotional stability with job satisfaction. *Journal of Applied Psychology, 86*(1) 80-92.

Lee, T. W., Mitchell, T. R., Wise, L., & Fireman, S. (1996). An unfolding model of employee turnover. *Academy of Management Journal, 39*(1), 5-36.

March, J. G., & Simon, H. A. (1958). *Organizations.* New York, NY: Wiley.

Marshall, A. (1949). *Principles of Economics* (8th ed.)..New York, NY: McGraw-Hill.

Martin, C. (2003). Explaining labor turnover. Empirical evidence from UK establishments. *Labour 17*(3), 391-412.

Mathew de Paula. (2005).With rising teller turnover, banks aim to retain. *US Banker, 115*(1), 54.

Mirvis, P. H., & Lawler, E. E. (1977). Measuring the financial impact of employee attitudes. *Journal of Applied Psychology, 62*(1), 1-8. doi: 10.1037/0021-9010.62.1.1

Mitchell, T. R., Holtom, B. C., Lee, T. W., Sablynski, C. J., & Erez, M. (2001). Why people stay: Using job embeddedness to predict voluntary turnover. *Academy of Management Journal, 44*(6), 1102-1121.

Mobley, W. H. (1977). Intermediate linkages in the relationship between job satisfaction and employee turnover. *Journal of Applied Psychology, 62*, 237-240.

Mobley, W. H. (1982). *Employee Turnover: Causes, consequences, and control*. Reading, MA: Addison Wesley.

Mobley, W. H., Griffeth, R. W., Hand, H. H., & Meglino, B. M. (1977). Review and conceptual analysis of the turnover process. *Psychological Bulletin, 86*, 493-522.

Morice, L. C. & Murray, J. E. (2003). Compensation and teacher retention: A success story. *Educational Leadership, 60*(8), 40-43.

Morrow, P., & McElroy, J. (2007). Efficiency as a mediator in turnover –organization performance. *Human Relations, 60,* 827-849. doi: 10.1177/0018726707080078

Muchinsky, P. M., & Morrow, P. C. (1980). A multidisciplinary model of voluntary employee turnover. *Journal of Vocational Behavior*, 17, 263-290. doi:10.1016/0001-8791 (80)90022-6

Nafukho, F. M. (2009). HRD's role in identifying, measuring, and managing knowledge assets in the intangible economy. *Advances in Developing Human Resources, 11*(3), 399-410. doi: 10.1177/1523422309337718

Nalbantian, H. R., & Szostak, A. (2004, April). How fleet bank fought employee flight. *Harvard Business Review*, 116-125.

Porter, L. W., & Steers, R. M. (1973). Organizational, work, and personal factors in employee turnover and absenteeism. *Psychological Bulletin, 80,* 151-176. doi: 10.1037/h0034829

Price, L. J. (1975). A theory of turnover: In B.O. Pettman (Ed.), *Labor turnover and retention* (pp. 51-75). New York, NY: John Wiley &Sons.

Schlesinger, L., & Heskett, J. (1991).Breaking the cycle of failure in services. *Sloan Management Review, 32*, 17-28.

Schneider, B. & Bowen, D. E. (1985). Employee and customer perceptions of service in banks: Replication and extension. *Journal of Applied Psychology*, *70*(3), 423-433.

Spector, P. E. (2006). *Industrial and organizational psychology: Research and practice.* Australia: Wiley.

Staw, B. M. (1980). The consequences of turnover. *Journal of Occupational Behavior, 1*(4), 253-273. Retrieved from http://www.jstor.org/stable/3000143

Swanson, R. A., & Holton, E. F. (2001). *Foundations of human resources development.* San Francisco, CA: Berrett-Koehler.

Taylor, J. (1999, April). Avoid avoidable turnover. *Workforce*. Retrieved from www.workforceonline.com

U.S. Bureau of Labor Statistics. (2010). Labor Force Statistics from the Current Population Survey Retrieved from http://www.bls.gov/cps

Modern Automobile Maintenance in Nigeria: Technical Skills Needs of Technical College Students

Matthew A. Odigiri
University of Jos, Nigeria
Benjamin A. Ogwo
State University of New York, Oswego

Abstract

This study was designed to identify the skills need of service personnel for effective maintenance of modern automobiles and technical college curriculum review in Nigeria. Automobile mechanics and technical college teachers were purposively sampled. A structured questionnaire was administered to 56 mechanics from two automobile assembly plants and 11 technical college teachers from Benue, Enugu, and Kaduna states. Four null hypotheses were tested using the t-test statistics. Among other findings, the following needed skills set were identified: correct interpretation of warning and trouble codes from electronic diagnostic tools; application of vehicle manual specifications on the new systems; troubleshooting and faults diagnoses on some of the new subsystems. These findings when acted upon would improve the occupational competence of graduating students.
Keywords: Nigeria, Technical College, automobile, curriculum, technical skills, technological innovations

Introduction

Changes in technology have continued to bring about changes in the workplace. New technologies are resulting in new work curricular contents, often involving new processes, using new tools and equipment. Such changes usually demand new work skills and therefore new educational requirements. The common reactions to such changes in technology and occupational skills have been the re-training of workers in order to update/upgrade their knowledge/skills (Okorie, 2000). These in turn usually require revision of schools curricula to enrich and update their contents so that school programmes may provide adequate knowledge and skills (UNESCO-Nigeria, 2008 - 2011). Of

particular reference is the automobile industry, where there have been tremendous changes and innovations in the last two decades. These innovations have focused on the attainment of some minimal standards of safety, economy and environmental friendliness among other things. In turn, these technological changes have become more or less industry standards for the manufacture of all automobiles, and thus major marketing considerations for all manufacturers (Ford Motor Company, 2002). To achieve these new legal and industry standards, many new sub-systems and system components have been incorporated into modern automobiles. The automobiles have therefore become more sophisticated and complex to maintain (Nice 2001; Schwaller, 1993).

Some of the technological innovations in modern automobiles include safety airbags, Electronic Fuel Injection (EFI), Anti-lock Braking System (ABS), electronic ignition system, variable valve timing intelligence (vvt-i), On-board Detection and Diagnostic system (OBD), supercharging and emission control systems; Other innovations include All Wheel Driving system (AWD), All Wheel Steering system (AWS), active suspension, auto-active automatic transmission, global positioning and telematic information system, rear mounted sensor parking assistance, speed limit alarm, multiplex wiring, etc. (Glo-con, 2004 – 2007; Odigiri & Ede, 2010; Schwaller, 1993). These new sub-systems pose new challenges to the automobile service personnel, demanding new skills for their effective maintenance and repairs.

In Nigeria, educating and training of Mechanics and Auto-electricians respectively for the maintenance of the mechanical and electrical subsystems of all types of motor vehicles have been carried out in the technical colleges at the National Technical Certificate (NTC) and Advance National Technical Certificate (ANTC) levels (NBTE, 1985). However, due to the increasing interrelationships and interdependence among the electrical/electronics and mechanical components of modern automobiles, automotive service electricians' and mechanics' responsibilities have become interwoven and also evolved from simple repairs to high-level technology-related works. In view of this, MB-ANAMMCO (2003) asserted that there was an international trend towards an all-round mechanic who shall be responsible for the complete automobile. MB-ANAMMCO further emphasized that due to the electronic control of most systems of modern automobiles, classical mechanical repairs were losing their significance; the central activity of the modern automotive workshop was rapidly becoming diagnosis and standard servicing; and good command of these skills call for sound knowledge of modern vehicle systems and in particular, methodical competence.

The U. S. Bureau of Labor Statistics (2008 - 09) pointed out that the increasing sophistication of automobiles requires workers who can use computerized shop equipment and work with electronic components while maintaining their

skills with traditional hand tools, and as a result, automotive service workers are now usually called technicians rather than mechanics. These views also agree with Schwaller (1993) who posited that due to the great number of mechanical and electrical systems of modern automobiles, proper service becomes an imperative. Schwaller added that the automotive service personnel of today must understand not only the parts, nomenclature and operations but must also understand the diagnosis and service procedures for each system in the vehicles. Due to these new trends, empirical evidences show that the bulk of automobile service craftsmen graduating from the technical college programmes in Nigeria lacked the skills and competences needed for gainful employment in the modern automobile industry (Agbata, 2000; Elobuike, 1999; Enemali, 1991; Jimoh, 1997). It is also a common experience that when automobiles with technological innovations such as auto-active automatic transmission, Electronic Fuel Injection (EFI), variable valve timing intelligence (vvt-i), etc. developed faults, they suffer trial and error attempts for the faults diagnoses and repairs in the hands of these skills obsoleted craftsmen. The trials and error in most cases result in damages to otherwise functional subsystems of the vehicles and even greater damages to the faulty system. As a result, many of the vehicles with these new systems are often packed indefinitely just very early in their service lives. In other cases the functional course of action is to have these new systems replaced with the less effective older versions whose performances tend to impede the over all function of the vehicle thus amounting to mixing old and new wine in the same vase.

There is therefore the need to update and upgrade the knowledge and skills components of the curriculum for the technical college motor vehicle mechanics work programmes. This will be necessary to equip the pre-service and in-service personnel with both operational and strategic capabilities for career in the automobile industry. Thus this study sought to identify the knowledge and skills set needed by technical college graduates for effective routine maintenance services as well as diagnosis of faulty subsystems of modern automobiles. Specifically, the study aimed to find the skills entailed in the maintenance and repair of the new innovations in automobiles relative to: safety and vehicle specifications, new subsystems and components identification, troubleshooting and faults diagnoses, and routine maintenance and repair services.

Hypotheses

The following null hypotheses were tested using the t-test statistics at .05 levels of significance. HO1: There is no significant difference in mean responses of Industrial Workers (IW) and Technical Teachers (TT) on the skills entailed of new technological innovations in automobiles relative to safety

and vehicle specifications. HO2: There is no significant statistical difference in mean responses of Industrial Workers (IW) and Technical Teachers (TT) on the skills entailed of new technological innovations in automobiles relative to new subsystems and components identification. HO3: There is no significant difference in mean responses of Industrial Workers (IW) and Technical Teachers (TT) on the skills entailed of new technological innovations in automobiles relative to troubleshooting and faults diagnoses. HO4: There is no significant difference in mean responses of Industrial Workers (IW) and Technical Teachers (TT) on the skills entailed of new technological innovations in automobiles relative to routine maintenance and repair services.

Methods

This study utilized the survey method to elicit information from samples of automobile mechanics in industries as Industrial Workers (IW) and motor vehicle mechanics work teachers in technical colleges as Technical Teachers (TT). Benue, Enugu and Kaduna states were selected as areas of study because of the presence of two functional automobile assembly plants and several technical colleges offering the motor vehicle mechanic work programmes which provided sizeable cluster samples of the population of study. A total of 81 respondents consisting of 50 mechanical technology staff of the two automobile assembly plants – MB–ANAMMCO, Enugu and Peugeot Automobile of Nigeria (PAN), Kaduna and 31 teachers of motor vehicle mechanics work from 11 technical colleges in the three selected states were studied. Data obtained from 56 respondents representing 69 percent returns were analyzed.

The instrument for data collection was a researcher-designed structured questionnaire. It was structured in the form of a five-point rating scale indicating the degrees of importance of suggested skills to be checked by the respondents as extremely important, very important, just important, unimportant and very unimportant. The response category of the questionnaire was assigned numerical values of 5, 4, 3, 2 and 1 respectively. These values were used to calculate the mean responses while the true limits of the numerical values were used to decide the appropriate response categories of the mean scores. At .05 levels of significance and degree of freedom (*df*) of 54, the critical-t value for accepting or rejecting the null hypotheses was 2.000.

Results

The summaries of results obtained from the study are tabulated relative to the hypotheses they addressed as follows:

Hypothesis One (HO1):

There is no significant difference in mean responses of Industrial Workers (IW) and Technical Teachers (TT) on the skills entailed of new technological innovations in automobiles relative to safety and vehicle specifications.

Table 1
The T-Test of Industrial Workers (IW) and Technical Teachers (TT) Mean Responses on Safety and Vehicle Specifications Skills

	IW		TT		GM		
New Skills	0_1	s_1	0_2	s_2	0	t-cal	Remark
1. Recognize and obey all safety rules and practices in all operations involving the new systems	4.79	0.41	4.78	0.42	4.79	0.089	EI
2. Identify and appropriately apply safety devices and equipment	4.52	0.69	4.67	0.48	4.59	0.951	EI
3. Locate and identify vehicle identification number (VIN) on different automobiles	3.93	0.75	4.11	0.80	4.02	0.865	VI
4. Correctly interpret the number and letter codes in VIN to ascertain vehicle characteristics	3.93	0.84	4.07	0.83	4.00	0.627	VI
5. Correctly interpret and and apply manuals' specifications on each new subsystems	3.93	0.84	4.15	0.72	4.04	1.054	VI

df = 54; critical-t = 2.000; GM = grand mean; EI = extremely important; VI = very important

Table 1 show that the safety skills were rated as extremely important while the VIN and manuals related skills were rated as very important. The table also show that the calculated t-value for all the items were lower than the critical t-value of 2.000. This means that the differences in mean responses of Industrial Workers and Technical Teachers were not statistically significant for all the items. Null hypothesis one (HO1) was therefore accepted for all the items meaning that both groups agreed on all the items identified.

Hypothesis Two (HO2):

There is no significant statistical difference in mean responses of Industrial Workers (IW) and Technical Teachers (TT) on the skills entailed of new technological innovations in automobiles relative to new subsystems and components identification.

Data in table 2 shows that all the items were rated as very important skills needed by the technical college students for effective maintenance services and

repair of modern automobiles. The table also shows that the null hypothesis was rejected for one of the new skills – Use the table of parts location to locate the components of each of the new subsystems on different automobiles, for which the difference in mean responses between the two groups of respondents was statistically significant.

Table 2

The T-Test of Industrial Workers (IW) and Technical Teachers (TT) Mean Responses on New Subsystems and Components Identification Skills

	IW		TT		GM		
S/N New Skills	0_1	s_1	0_2	s_2	0	t-cal	Remark
6. Describe the operations of each of the new systems	3.86	0.74	3.89	0.89	3.88	0.136	VI
7. Identify each of the new subsystems in automobiles	4.00	0.80	4.22	1.01	4.11	0.897	VI
8. Identify different types of sensors and systems in which they are used	4.24	0.44	4.04	0.81	4.14	1.141	VI
9. Use table of parts location to locate the components of each of the new subsystems on different automobiles	3.79	0.82	4.26	0.81	4.02	2.154*	VI
10. Identify the correct connectors with the control modules for different electronic subsystems	3.86	0.88	3.89	0.93	3.88	0.124	VI
11. Identify electrical/ electronics components such as integrated circuits (ic's) fuses, diodes, resistors, capacitors, etc. in automobiles	4.00	0.76	4.33	0.79	4.16	1.600	VI
12. Identify the assembly line and diagnostic link (ALDL) to access stored trouble codes with off-board diagnostic tools	3.93	0.80	3.52	0.98	3.73	1.713	VI
13. Read and correctly interpret electrical/electronics circuit diagrams and schematics	4.14	0.79	4.15	0.86	4.14	0.045	VI
14. Recognize and trace electrical/electronics circuits by wire colour codes, sizes and number codes	4.38	0.49	4.22	0.75	4.30	0.935	VI
15. Recognize the characteristics and identify fluids for different new subsystems where applicable	3.90	1.01	4.00	0.73	3.95	0.425	VI

df =54; critical-t =2.000; GM=grand mean; EI=extremely important; VI=very important

Hypothesis Three (HO3):

There is no significant difference in mean responses of Industrial Workers (IW) and Technical Teachers (TT) on the skills entailed of new technological innovations in Automobiles relative to troubleshooting and faults diagnoses.

Table 3
The T-Test of Industrial Workers and Technical Teachers Mean Responses on Troubleshooting and Faults Diagnoses Skills

		IW		TT		GM		
S/N	New Skills	0_1	s_1	0_2	s_2	0	t-cal	Remark
16.	Identify and select appropriate test tools/ equipment for any test operations on the new subsystems	3.97	0.82	4.41	0.64	4.18	2.247*	VI
17.	Carry out troubleshooting and faults diagnoses on the new subsystems using test tools/equipment	4.48	0.51	4.41	0.57	4.45	0.483	VI
18.	Carry out troubleshooting and faults diagnoses on the new subsystems by road tests	4.00	0.85	4.48	0.58	4.23	2.493*	VI
19.	Recognize and correctly interpret warning and trouble codes from electronic diagnostic tools	4.35	0.67	4.37	0.74	4.36	0.106	VI
20.	Identify and locate sub-systems in which indicated coded troubles are located	4.28	0.59	4.00	0.92	4.14	1.344	VI
21.	Initiate demand diagnoses with on-board diagnostic tools	3.76	0.83	3.30	0.99	3.54	1.783	VI
22.	Correctly connect and apply off-board detection and diagnostic tools	3.83	0.83	3.59	1.01	3.73	1.087	VI
23.	Recognize lag periods in electronic diagnostic tools before trouble codes from different subsystems set in	3.66	0.81	3.85	0.95	3.63	0.801	VI
24.	Correctly use jumper wire on the service check connector to access stored trouble on certain automobiles	3.66	0.81	3.59	0.93	3.63	0.299	VI
25.	Determine the failure of semi-conductor components by tests	3.45	0.69	3.95	0.96	3.68	2.142*	VI

*df = 54; critical-t = 2.000; GM = grand mean; VI = very important; *= significant at .05*

Table 3 shows that all the indicated skills were rated as very important to the service personnel in the study of the new technological innovations in automobiles. The table also shows statistically significant differences in mean responses of Industrial Workers (IW) and Technical Teachers (TT) on three items for which null hypothesis three was rejected. These items have calculated t-values of 2.247, 2.493 and 2.142 which are all higher than the critical-t of 2.000.

Hypothesis Four (HO4):

There is no significant difference in mean responses of Industrial Workers (IW) and Technical Teachers (TT) on the skills entailed of new technological innovations in Automobiles relative to routine maintenance and repair services.

Table 4 shows that all the indicated new skills were relevant to the automobile service personnel as they were all rated very important. The table however shows that the difference in mean responses of the two groups of respondents was statistically significant on one item – Carry out 4-wheel alignment with a computerized wheel alignment machine, which has the calculated t-value of 2.717.

Table 4
The T-Test of Industrial Workers and Technical Teachers Mean Responses on Routine Maintenance and Repair Services Skills

	IW		TT		GM		
S/N New Skills	0_1	s_1	0_2	s_2	0	t-cal	Remark
26. Identify and select appropriate work tools (including special tools) for any jobs on the new subsystems	4.35	0.55	4.52	0.58	4.43	1.121	VI
27. Follow the correct procedures for any servicing and repair of the new subsystems (including those involving special procedures)	4.35	0.67	4.63	0.49	4.48	1.791	VI
28. Carry out routine maintenance services on the new subsystems	4.30	0.66	4.44	0.51	4.38	0.831	VI
29. Carry out 4-wheel alignment with a computerized wheel alignment machine	3.69	0.81	4.26	0.76	3.96	2.717*	VI
30. Service or replace sensors for any sensed systems without wrongly activating the systems	4.10	0.72	3.78	1.05	3.95	1.318	VI
31. Recognize the tolerance ranges for replacement components of electrical/ electronic subsystems	3.55	0.74	3.74	0.71	3.64	0.982	VI
32. Select correct replacements for failed components of electrical/ electronic systems	4.05	0.75	4.22	0.75	4.14	0.749	VI

S/N	New Skills	IW 0_1	IW s_1	TT 0_2	TT s_2	GM 0	t-cal	Remark
33.	Correctly carry out replacement of through-hole components in printed circuits	3.72	0.70	3.63	0.93	3.68	0.408	VI
34.	Assess components of the new subsystems to determine when to reuse or replace	3.86	0.92	4.00	0.68	3.93	0.653	VI
35.	Assess the quality of replacement parts to ascertain correct							

*df = 54; critical-t = 2.000; GM = grand mean; VI = very important; * = significant at .05*

Summary of the Findings

Thirty-eight broad skills entailed in the study of the new technological innovations in automobiles were rated as important skills needed by the technical college students for effective routine maintenance, faults diagnoses and repairs of automobiles with new technological innovations which were yet to be integrated into the curriculum of Nigerian Technical College motor vehicle mechanics work programmes. Some of these skills include:

- Obey all safety rules and practices in all operations involving the new systems;
- Correctly interpret and apply manual specifications on the new systems;
- Identify any of the new systems in automobiles;
- Use the table of parts location to locate the components of any of the new systems in automobiles;
- Identify and select appropriate test tools/equipment for any test operations on the new systems;
- Recognize and correctly interpret warning and trouble codes from electronic diagnostic tools;
- Initiate demand diagnostic in on-board detection and diagnostic tools;
- Identify and locate systems in which indicated coded troubles are located;
- Identify and select appropriate work tools (including special tools) for any jobs on the new systems;
- Follow the correct procedures for any services and repairs of the new subsystems (including those involving special procedures);
- Assess the quality of replacement parts to ascertain correct standards;
- Carry out repairs (including parts replacements) on the new systems;
- Conduct after service/repair checks to confirm completed works; etc.
- The differences in mean responses of Industrial Workers and Technical

Teachers on the important skills entailed in the study of the new technological innovations in automobiles were statistically significant on five items. These items include:

- Use the table of parts location to locate the components of each of the new subsystems on different automobiles;
- Identify and select appropriate test tools/equipment for any test operations on the new systems;
- Carry out troubleshooting and faults diagnoses on some of the new subsystems by listening and road tests;
- Determine the failure of semi-conductor components by tests; and
- Carry out 4-wheel alignment with computerized wheel alignment machine.

Discussion

Regular curricula revision and update are imperatives for occupations prone to rapid changes in technology. Copa and Copa (1992) observed that the inherent challenge with designing learning programmes to meet changing skills requirements is that there was little consensus about future requirements. Suggesting the remedy to the effects of uncertainties about the ways and levels of future changes in technology and in work skills requirements, UNESCO (1995) opined that the only way to deal with the problems of developing practice oriented education in times of radical economic and technological changes was to bring vocational education close to the existing reality of the industry. In the same vein, UNESCO-Nigeria (2008 - 2011) and Rutayuga and Kondo (2004) proposed proactive responsiveness by curriculum planners. Therefore the continual adoption, in Nigerian technical colleges, of a curriculum developed as far back as 1985 (NBTE, 1985) will only succeed in teaching the skills of yesterday's technologies to today workers, which is a complete departure from the opinions advocating responsiveness and the bringing of vocational education to the existing reality of the industry. When viewed from the perspective of the graduates' ability to secure and retain employment in the automobile industry prone to skills obsolesce due to rapid technology innovations there should be statutory provision to review the curricular content every three years. The identification of the skills entailed in the study of the technologies of modern automobiles in this study was therefore imperative and timely to be used to update and upgrade the curricula contents to prepare the Nigerian automobile service personnel for today automobiles.

Although some elements of the indicated skills are generic and could be acquired through the study of the technologies of the classical automobiles, it was necessary to identify and present the comprehensive list of skills entailed in the study of the new innovations into context, which agrees with an opinion of

NQC (2009) that competency makes appropriate reference to required generic and employability skills. More particularly, the inclusion of these generic skills such as safety skills became necessary because the learning contents as well as tools and equipment needed for teaching some of the skills were not reflected in the curriculum in use (NBTE, 1985). The extremely important or very important ratings of all the skills reflect the magnitude of the gap between the skills component of the curriculum in use and the state-of-the-art technologies in the automobile industry. It also reflects the degree of importance attached to precision and procedural accuracy in the maintenance and repair of the mostly electronically-controlled subsystems of modern automobiles. Similarly, the large number of skills on electrical/electronics subsystems rated as important for the automobile mechanic reiterates the statement by MB-ANAMMCO (2003), that classical mechanical repairs was loosing significance due to the increasing electronic control of most systems of modern automobiles, hence the trend towards an all-round mechanic who will be responsible for the complete vehicle.

Although opportunities for specialization may still exist in automobile assembly plants and large service stations, the integration of all aspects of the automobile into the progammes for training of automotive service craftsmen in Nigeria is incontestable since most graduates will go to be self-employed or at best be employed by small dealerships and service stations or Government agencies where the personnel may be required to work on all parts of the vehicle. This is in tune with international and African best practices to link training to employment, either self or paid employment (AU, 2007; UNESCO-ECOWAS, 2009). Similarly, other employment opportunities such as parts sales and accident vehicles inspection for insurance companies also require knowledge of the complete vehicle.

The statistically significant differences in mean responses of industrial workers and technical teachers on five of the identified skills may be explained as a factor of inadequate knowledge about the new innovations on the part of the teachers, many of whom may have not had any retraining in the industry for a long while. This may be most probable as the mean responses of the teachers were lower than those of the industrial workers in all the five cases, signifying that the teachers attached less importance to those items than the industrial workers who deal constantly with the new innovations as soon they were introduced. The findings of this study will therefore have strong implications for the training of the Technical Teachers (TT).

Conclusion and Recommendations

A number of both generic and new skills are entailed in the study of the new technological innovations in automobiles as can be seen in the findings of this study. Many of these skills involve the selection and application of new types of sophisticated digital tools and equipment and using new procedures in the

diagnoses and repair of faults in the modern automobile systems. Unlike in the classical mechanical works, the application of digital tools requiring high degree of precision and methodical accuracy has become a must for working on the electromechanical subsystems of modern automobiles. The curriculum for motor vehicle mechanics work programs of Nigerian Technical Colleges must therefore provide for training in these skills if the graduates of such programs will secure and maintain employment as maintenance service craftsmen in today's automobile industry.

Based on the findings of this study, the authors suggest a number of recommendations. First of all, the National Board for Technical Education (NBTE) should, as a matter of urgency, initiate the necessary modalities to ensure that instructions in the new technological innovations in automobiles commenced in the technical colleges as soon as possible. Secondly, since no educational program can rise above the standard of its teachers and nobody can offer what he or she has not, the learning contents of programmes that train the technical teachers on motor vehicle mechanic works should be updated and upgraded to incorporate the new technological innovations in automobiles in order to equip them with the technical and pedagogical skills they will need to facilitate learning of the new skills. Additional training on the skills entailed in the learning of the new technological innovations in automobiles in the technical colleges should be arranged in modular form to enable earlier graduates of the programmes who may be interested in acquiring the new skills to go and take only the modules that are relevant to their skills need.

To conclude, a more effective and functional collaborative framework should be put in place among stakeholders like the Federal and States Ministries of Education, Federal and States Ministries of Science and Technology, National University Commission (NUC), National Education Research and Development Centre (NERDC), National Science and Technology Incubation Centres, Industrial Training Fund (ITF), National Board for Technical Education (NBTE), Industries, etc. for the collation of all relevant existing and emerging Industrial Technologies into a National Technology Data Bank, from where the National Curriculum Agencies and/or accreditation bodies like the National Board for Technical Education (NBTE), the National Council for Colleges of Education (NCCE) and National Universities Commission (NUC) can readily access information on new technological innovations for upgrading and updating the curricula for the Technical Colleges, Colleges of Education, Polytechnics and Universities programmes as at when due.

References

Agbata, V. I. N. (2000). *Relevance of the technical college auto mechanics curriculum to the automobile industry in Anambra State.* Department of Vocational Teacher Education, University of Nigeria, Nsukka. Unpublished M.Ed. Thesis.

AU, (2007). Strategies to Revitalize Technical and Vocational Education and Training (TVET) in Africa (Final Draft). Meeting of the Bureau of the Conference of Ministers of Education of the African Union (COMEDAF II+), 29 – 31 May 2007, Addis Ababa, Ethiopia. Retrieved from http://www.unevoc.unesco.org/wiki.0.html?&no_cache=1&tx_drwiki_pi1[keyword]=Africa

Copa, G. H., & Copa, P. M. (1992). Vocational education. In M. C. Alkin (Ed.), *Encyclopedia of Educational Research* (6th ed.). New York, NY: Macmillan Co.

Elobuike, H. U. (1999). Relevance of Technical College Electrical/Electronics and Mechanical/Automobile Programmes to the Needs of Industries in Anambra, Ebonyi and Enugu States. Department of Vocational Teacher Education, University of Nigeria, Nsukka: Unpublished Ph.D. Dissertation.

Enemali, J. D. (1991). An Evaluation of the Quality of Training Received and It's Influence on the Job Performance of Technical College Graduates. Department of Vocational Teacher Education, University of Nigeria, Nsukka. Unpublished M.Ed. Thesis.

Ford Motor Company. (2002). *Safety*. Retrieved from http://www.ford.com/en/ourcompany/newsroom/worldidep…/saferandhealthierworld

Glo-con, (2004 - 2007). Cars for Sale by Owner: Cars for Sale Listings in Glo-con's International Cars for Sale Directory – Articles. Retrieved from http://cars.glo-con.com/articlelist.php?

Jimoh, J. A. (1997). Auto mechanic Skills Needed by Technical College Students for self-employment. Department of Vocational Teacher Education, University of Nigeria, Nsukka. Unpublished B.Sc (Industrial Education) Thesis.

MB-ANAMMCO, (2003). *Vocational training: Key to industrialization. MB-ANAMMCO News,* Pp. *19*.

National Quality Council (NQC). (2009). VET Products for the 21st Century. Final Report of the Joint Steering Committee of National Quality Council (NQC) and Council of Australian Governments (COAG) Skills and Workforce Development Subgroup. Retrieved from http://www.nqc.tvetaustralia.com.au/__data/assets/pdf_file/0004/49657/VET_Products_for_the_21st_Century_-_FINAL_REPORT.pdf

NBTE. (1985). *National technical certificate and advanced national technical certificate curriculum and module specification for vehicle mechanics work.* Kaduna: NBTE

Nice, K. (2001). *How car computers work*. Retrieved from http://www.howstuffworks.com

Odigiri, A. M., & Ede, E.O. (2010). Integration of new technological innovations in automobiles into the curriculum for Nigerian technical college programmes. *International Journal for Vocational and Technical Education*, *2*(5), 89–94.

Okorie, J. U. (2000). *Developing Nigeria's workforce*. Calabar: McNky Environs Publishers.

Rutayuga, A. B., & Kondo, A. (2004). *Reforming technical and vocational education in Tanzania*. A Paper Presented at the Third Conference of the Association of Commonwealth Examinations and Accreditation Bodies (ACEAB), 8th – 12th March. Retrieved from http://www.spbea.org.fj/aceab/KondoRutayuga.pdf

Schwaller, A. E. (1993). *Motor automotive technology.* New York: Delmar publishers Inc

UNESCO, (1995). *The development of human resources: New trends in technical and vocational education.* Paris: UNESCO.

UNESCO - ECOWAS, (2009). *Workshop on revitalising TVET provision in ECOWAS countries*. Abuja, 17th–20th August, 2009. Retrieved from http://www.nbte.gov.ng/downloads/UNESCOECOWAS%20Final%20Workshop%20Report.pdf

UNESCO - Nigeria (2001-2004). UNESCO-Nigeria TVE Revitalisation Project (Phase I), In Support for Revitalising Technical and Vocational Education (TVE) in Nigeria. Retrieved from http://unesco-nigeriatve.org/

UNESCO - Nigeria (2008-2011). UNESCO-Nigeria TVE Revitalisation Project (Phase II), In Support of Revitalisation of Technical and Vocational Education (TVE) in Nigeria. Retrieved from http://unesco-nigeriatve.org/

U. S. Bureau of Labor Statistics (2008-2009). Automotive service technicians and mechanics. In *Occupational outlook Handbook*. Retrieved from http://www.bls.gov/oco/ocos181.htm.

The Fluency Development Lesson: Improving Reading in Career-Technical Education

Belinda S. Zimmerman and Patrick J. O'Connor
Kent State University, USA

Abstract

Career-Technical Education (CTE) has experienced a number of factors in recent years that have prompted significant changes in how CTE programs in the United States are delivered. A major change has been the increased expectations for connecting with academic instruction. Students have to increase their academic competence to meet employer needs as well as the expectations of post-secondary education. To meet these expectations, CTE students and their teachers must be more competent in reading. This article discusses the importance of reading in CTE and provides guidance on how to use the Fluency Development Lesson (FDL) which is a widely accepted strategy for improving student reading ability. Specific guidelines for implementing the FDL in the CTE classroom are provided.

Introduction

Content Area Literacy

Content area literacy instruction must be viewed as the cornerstone of any comprehensive movement to build the kinds of thriving, intellectually vibrant secondary school young people deserve and on which the nation's social and economic health will depend (Heller & Greenleaf, 2007, p.1).

Career-Technical Education (CTE) is at the heart of economic health in the United States considering it prepares students for the current and future workforce. It is also at the center of our nation's social health as job creation and development are essential to personal, family and social stability. The stronger the literacy skills the more likely adults are to hold a full-time job, vote in national elections, participate in community organizations, volunteer and help their children with their homework (Heller & Greenleaf, 2007).

The overall quality of literacy in our society, which includes reading, writing and communication, continues to be problematic. Numerous reports and statistics bear out the persistent difficulty American students and society in general have with literacy. For example, only 35% of 12th grade students are considered proficient in reading and can demonstrate overall understanding of texts, make inferences, draw conclusions and make connections to previous experiences. The statistics are even lower for minorities, students with disabilities and English language learners (U.S. Department of Education, 2005). Further, from 1992 to 2005, the percentage of high school seniors performing at "basic" level or above reading levels actually dropped (National Assessment of Educational Progress [NAEP], 2005). The basic problems seem to focus on the student's ability to decode words and to comprehend. As such, improving reading comprehension across the curriculum has become a major priority (O'Connor, Bintz & Murray, 2009).

Contemporary Career-Technical Education

CTE in the United States has experienced considerable change in recent years. Numerous factors are prompting changes that require students to offer a different skill set to employers. Employers need employees with a greater academic background. The ability to read, write and think critically is becoming a minimum requirement even for entry-level jobs in sectors ranging from business to manufacturing to the professional trades (Barton, 2003). For example, the reading levels required for most entry-level jobs are well above that of the average high school student (Association of Career and Technical Education [ACTE], 2010). Thus, the decline in literacy rates is particularly disturbing considering the workplace has increased expectations for literacy levels. For example, employers expect employees to have the following abilities when they enter the workforce:

- Employees must use more higher-order thinking skills such as critical thinking, problem solving and teaming to be competent. The increase in academic expectations has led to CTE programs that include integrated curricular approaches in which math, science and language arts are taught in applied, contextual ways (Finch & Crunkilton, 1999; Scott & Sarkees-Wircenski, 2001).
- Employees must be life-long learners because of the constant change occurring in work processes. They must also have a set of basic educational skills, including the social and self-directed competencies required in a high-performance workforce. In effect, learning is part of the continuous improvement process (O'Connor, 2006).
- Employees must be more adaptable as technology continues to play a vital

role in the workplace. This flexibility is essential given the rapid advances in technology which necessitates that employees "keep up" on the most current technological developments.

- Globalization is affecting all aspects of education including CTE. The Carnegie Council (2010) reports that the pace of literacy improvement has not kept up with the demands of the growing economy. This puts students at risk for dropping out, underperforming or graduating without the skill preparation for college, work or citizenship (Carnegie Council, 2010).

With the previous points in mind, CTE programs are responding to employer expectations with higher academic expectations, greater academic integration and more post-secondary educational outcomes. For example:
More programs are adopting the 21st century skills framework that blends academics with specific occupational skills and global themes (Partnership for 21st Century Skills, 2009).

- More CTE programs have college preparation as an outcome. This is especially true for two-year post-secondary institutions that provide the bulk of training for middle-skill occupations which are in high-demand (ACTE, 2010).
- CTE graduates are expected to have life-long learning skills to adapt to the myriad of changes that occur in the workplace mainly in technology and work processes. A Carnegie Council on Advancing Adolescent Literacy (2010) report indicated our adolescents are not being adequately prepared for the demands of higher education, employment and citizenship in the 21st Century.

The Problem

The skills required to earn a decent income have changed radically. The skills taught in most U.S. Schools have not (Murnane & Levy, 1996). This statement was made 15 years ago yet many of the same concerns exist today. CTE can be part of the solution and has enormous potential to develop the reading proficiency level of its students. Furthermore, CTE can be a powerful ally to educators who teach complex and high technical concepts (Vaites, 2003).

The bulk of CTE students and programs are at the high school (secondary) level. Much of the emphasis to teach reading is focused on elementary (primary) grades. A strong knowledge base of reading instruction exists for grades K-3. However, literacy supports for adolescents present greater instructional challenges and demand a range of strategies. Learning at middle and high school levels have texts that are longer, more complex, contain detailed graphic representations such as charts, graphs, and present greater conceptual

challenges and demand the ability to synthesize information (Carnegie Council on Advancing Adolescent Literacy, 2010).

CTE is emerging as a reading content area similar to other academic subjects because it is becoming more integrated with academics (O'Connor, 2010). CTE teachers are a primary audience to develop improved reading for CTE students. However, CTE teachers have little background in teaching reading since many come from an alternative path and many lack strong mastery of numeracy and literacy themselves (Bottoms, 2010). In the US, many CTE teachers leave industry positions to enter teaching and work toward licensure requirements simultaneously. Also, CTE teachers are often faced with students who show opposition to reading in favor of more hands-on learning. And, in CTE classrooms the students are required to read highly technical and diverse texts which can be daunting to struggling readers (Bottoms, 2010). Therefore, there is need to identify and develop strategies to teach in CTE.

Goals

The intent of this article is to feature the Fluency Development Lesson (FDL) as a strategy CTE teachers can use to improve their students' reading. To this end, the specific aims are to:

1. Affirm the rising importance of content area reading in CTE.
2. Provide guidance in using the FDL as a strategy for CTE teachers to improve student reading comprehension.
3. Provide resources CTE teachers can use to increase quantity and quality of student reading.
4. Assist CTE teacher educators in providing reading content to prospective CTE teachers in licensure courses.

CTE as a Reading Content Area

CTE has excellent potential to teach reading. CTE programs are unique in that they feature two important qualities that can be developed to improve student reading. First, CTE programs feature three inter-related components that foster learning in the affective, cognitive and psychomotor domains. Teachers can coordinate and reinforce learning and reading from interrelated instructional perspectives (O'Connor, 2010). Secondly, CTE programs are occupational in nature which basically makes them contextual. This requires that CTE programs place students in authentic situations dealing with real problems and solutions.

Three Program Components of CTE Learning

Career-Tech Student Organizations (CTSO)

Career-tech student organizations are designed to support learning that occurs in the classroom and laboratory. Much of the focus of these co-curricular student organizations is to reinforce "soft skills" such as teaming, interpersonal communications and problem-solving. Groups such as DECA (a CTSO for Marketing Students), HOSA (Health Occupations Students of America), BPA (Business Professionals of America), Skills USA and others provide teachers an opportunity to engage students in reading. Contests/competition preparation, reports and manuals all require extensive reading. The CTSO also offers students opportunities to improve writing ability.

Laboratory Learning

CTE programs include laboratories that are replicas of an actual work setting. Learning in the lab setting enables students to read operational manuals, training booklets, directions, repair instructions, etc. This setting is especially effective for teaching psychomotor skills. In addition, learning in the lab reinforces problem solving and teamwork.

Classroom Instruction

The classroom instruction in a CTE program focuses on content in a specific occupational area which includes terminology, concepts and processes as well as general employability content. The occupational content is also closely connected to academic subjects.

Contextual Learning

CTE is contextual by providing students with real-life learning and experiences. Experiential learning opportunities are abundant through projects, service learning, internships, job-shadowing and laboratory applications of concepts. Students often interact with employers in real-world settings via field trips, early placement and team/group projects.

CTE is occupational and student interest is often high. In most cases, CTE students select the program they study based on personal and occupational interests. Often, students have to take entrance exams, interview with a CTE teacher or meet specific admission requirements to be accepted into a program. Research has shown that one of the best ways to help students gain literacy skills is to motivate and engage them with content related to their interests (National Council of Teachers of English, [NCTE], 2006). Also, interest is

likely to encourage students to read. When students read, write and communicate about their trades, vocabularies are significantly expanded and the scope of knowledge deepened (Vaites, 2003).

The Reading Needs of CTE Students and Teachers

The various changes and expectations evolving in the workplace have led to changes in the CTE classroom. Students and teachers each have their unique needs regarding these changes. Students must read more as content knowledge base expands. Also, students must read at higher levels as textbooks and instructional materials have higher academic standards. As such, CTE teachers must become more skilled and experienced in teaching reading in the content area.

CTE students need to improve word recognition, decoding and comprehension. They will also benefit when interest and motivation for reading are increased. Students with low literacy levels frequently become frustrated and disengage from the education process and drop out of high school at a higher rate than other students (ACTE, 2009).

Little research has been conducted on literacy strategies in CTE (Bottoms, 2010). As such, CTE teachers have little background in teaching reading and may need more support for teaching reading (O'Connor, 2010). Park (2010) reported that CTE teachers lack tools to successfully implement literacy. Often, the CTE teacher is placed into a classroom to teach while pursuing a licensure process part-time at a university. In effect, the CTE teacher is learning to become a teacher before they can be expected to teach reading. Bottoms (2010) reported that integrating academic content was especially challenging for this group of CTE teachers because some lacked mastery of the subjects themselves.

CTE teachers need the following to increase their ability to improve their students' reading:

- Increase the available strategies needed to improve student learning. CTE teachers need a wide assortment of instructional strategies on teaching literacy (Park, 2010).
- Create a culture of literacy in their classrooms. This requires an environment that includes many different types of reading materials to increase student choice. Also, the home environment and the reading students do "away" from school is considered part of a culture of literacy (O'Connor, Bintz & Murray, 2009).
- Follow a process for integrating reading into their programs. This process includes assessing student reading ability, offering prescribed strategies to meet reading needs, and monitoring specific reading behaviors that indicate reading improvement.

- Organize reading instruction that meets different student reading needs. CTE students are often in different places with their reading abilities and thus may require the teacher to offer a variety of reading strategies and techniques.

Current Efforts to Support Reading in CTE

The CTE community has undertaken a number of initiatives in recent years to support CTE teachers and students in reading. Various organizations have begun to establish a knowledge base for CTE as a reading content area. The Association for Career-Technical Education (2009), the Southern Regional Education Board and the National Research Center for Career and Technical Education have all initiated programs and projects designed to increase the connections between CTE and content area reading.

Many states including Ohio, Florida, North Carolina and others have established professional development programs designed to support the CTE teacher's ability to improve their students reading (ACTE, 2009). These efforts are designed to increase the amount of time CTE students spend reading and writing. Various techniques to improve student reading are taught to CTE teachers. Some states such as Maine and Kentucky have established multi-year strategic programs, some which include professional credentialing, designed to support CTE teachers in teaching reading (ACTE, 2009). Many university teacher licensure programs have included instruction in teaching reading. In some cases, the CTE teacher takes a course in reading in the content area. However, due to the nature of the licensure process, reading instruction may be incorporated in CTE licensure courses.

Reading in the CTE Classroom

While it is important that teaching reading is becoming increasingly embedded in teacher preparation programs, there is need for attention on high quality reading instruction outside of the reading classroom. Furthermore, it is important to stress that all teachers must teach reading if students are to achieve national standards and be competitive at world-class levels. In fact, our current national focus on student achievement highlights the importance of understanding how teachers can educate students so that all students are good readers.

Fluency: What it Means and Why it Matters?

Significant advances have marked our understandings of the most effective ways to provide high quality literacy instruction. Among the most interesting has

been the work of the National institute of Child Health and Human Development (2000). In a landmark study, the National Reading Panel merged the findings of literacy research into a report which identified five instructional factors necessary for reading success: phonemic awareness, phonics or word decoding, reading fluency, vocabulary, and comprehension. Fluency, once characterized as the neglected goal of the reading curriculum (Allington, 1983), was largely ignored and avoided as an area of instructional focus because of its association with oral reading, a skill considered unlikely to be favored among adult readers. Thus, reading fluency was not explicitly taught or systematically emphasized in the school reading curriculum (Rasinski & Zimmerman, 2011).

More recently, research has demonstrated that fluency is a necessary precondition for comprehension and achievement in reading and can be successfully taught to students of all ages. There are identified techniques for improving the fluency of struggling readers. Furthermore, although fluency is often associated with oral reading, instruction aimed at improving fluency yields gains in silent reading ability as well (Rasinski & Padak, 2005).

Rasinski and Padak (2005) posit that fluency may be defined in more than one way. One school of thought suggests that fluency is marked by the ability to decode words with little effort so the meaning of each word is understood. A second definition suggests that fluency is more than simple decoding. Rather, it is the process of making meaning out of chunks of text in ways that contribute to a reader's comprehension. This second definition also takes into account expressive oral reading and suggests that true fluency includes the ways oral readers phrase text, pause, emphasize and express enthusiasm when reading to others.

Why Readers Need to Achieve Fluency

In order to achieve fluency, the reader needs to be able to:

> "… read the words on the printed page accurately, effortlessly, or automatically so that readers can preserve their limited cognitive resources for the more important task in reading -- comprehension -- and with appropriate prosody or expression so as to give meaning to the words that is implied through emphasis, phrasing, and intonation." (Rasinski, 2006, p.1)

The reader must develop the ability to decode and comprehend at the same time in order to produce meaningful, expressive reading. Fluency in reading is important because it improves reading efficiency and comprehension.

When students are unable to gain fast and accurate decoding skills they not only struggle with reading comprehension, but they also fall behind their peers in academic achievement and attaining successful progress becomes increasingly difficult (Dudley, 2005). Once students with reading difficulties enter

middle and high school, the motivation to read and reread tends to decline. These students avoid tasks that require reading and often experience greater frustration, anxiety and disappointment resulting in less patience for participation in reading activities (Rasinski, 2010). This is particularly important for prospective CTE students. As they begin to struggle academically, students may be drawn to the authentic context of the CTE classroom. In the CTE classroom, students discover practical applications for reading and writing as these skills are tightly linked to areas of personal and potentially professional interest.

Another consideration is that fluency matters for both oral and silent reading. Once students gain some proficiency in decoding and word identification and can read some basic books, silent reading develops and students begin to use in-the-head thinking processes to access the meaning in texts (Clay, 2005). The goal of silent reading according to Topping (2006) is the "extraction of maximum meaning at maximum speed in a relatively continuous flow" (p. 173) so that the reader is cognitively freed up to deal with higher level thought processes. Silent reading is needed for students to succeed in school and perform well on tests that require students to have strong silent fluency capabilities. Interestingly, silent reading fluency is often emphasized the least, yet expected and tested the most (Gregg, 2010).

The Value of Fluency

Topping (2006) asserts that the value of fluency is in what it enables. Reading fluency has been characterized as "multi-dimensional" (Rasinski, 2004) because it makes possible several things:

- Accuracy in word decoding: Fluent readers no longer use their limited attentional resources to sound out words. They are able to word solve with minimal effort.
- Automatic word recognition of words embedded in connected text: Automaticity is achieved when the reader makes a cognitive shift from *conscious*, accurate decoding to *automatic* accurate decoding (Samuels, 2002; Stanovich, 1991). At this stage, words are recognized on sight with immediate accuracy.
- Comprehension: Perhaps most importantly, fluency enables comprehension which is the premier goal of reading. When readers have automaticity and accuracy under control, they can capitalize on this reserved brain energy to make sense of the text.

The Fluency Development Lesson

The Fluency Development Lesson (FDL) was developed by Rasinski, Padak, Linek, and Sturtevant (1994) as a supplement to the regular reading program. The main goal is to boost the reading progress of students who find learning to read difficult. Originally, an instructional model for struggling primary children, the FDL has been successfully used with elementary and middle/secondary school students as well as with English language learners. The FDL combines several aspects of effective fluency instruction in a way that maximizes students' reading in a relatively short period of time. The goal is to provide instruction and practice in a focused routine that incorporates principles of effective fluency instruction and multiple opportunities to practice authentic reading (Padak & Rasinski, 2008). The CTSO, laboratory learning class, and the classroom afford CTE teachers with three opportunities to implement the FDL. When implemented across all three settings, the potential for substantial improvements in reading are enhanced since reading progress is related to increased time on task and student performance (Gallagher, 2003).

The approach requires that students and teachers work for 10 to 15 minutes each day with a carefully selected text in which the teacher, or a more capable peer, models reading the text for the students. The teacher then gradually hands over the responsibility for the reading task to the students. Figures 1 and 2 illustrate the roles of the teacher and student in the FDL. The process includes:

- A first expressive reading by a fluent reader. In the CTE classroom this may be the teacher or it might be another student who has demonstrated strong fluency skills.
- Following the first reading, the text is then distributed to the students for several more expressive readings of the passage. With each attempt, the teacher and the student become aware of student improvement in reading rate, decoding and word recognition. Comprehension is also enhanced as rereading is a key strategy for both improving text recall and understanding (Rasinski, 2010). Throughout the repeated readings, the student is encouraged to underline or circle parts of the passage that interest or challenge them.
- At this juncture in the FDL, attention shifts from listening to the spoken word to determining what the passage offers the reader. Discussion focuses on developing meaning and comprehension of the material as well as identifying unknown vocabulary words. In the case of the CTE classroom, it is expected that vocabulary might include technical terms or concepts.
- Once the meaning of the passage is clear and key vocabulary is defined, it is time for the students to read the passage in pairs without teacher support.

This choral reading reinforces fluency in that it allows students to practice reading in a fluid, confident way.

- Students should then practice the passage by alternating the reading with their partner paying close attention to expression, word accuracy and fluency. At this time, students may continue their discussion of the content of the passage, broadening their comprehension by working with the ideas contained within the text as they focus on proper use of the vocabulary in the passage in their own conversation.
- Finally, students will individually practice reading the passage, both orally and silently as a way to gain lasting fluency skills.

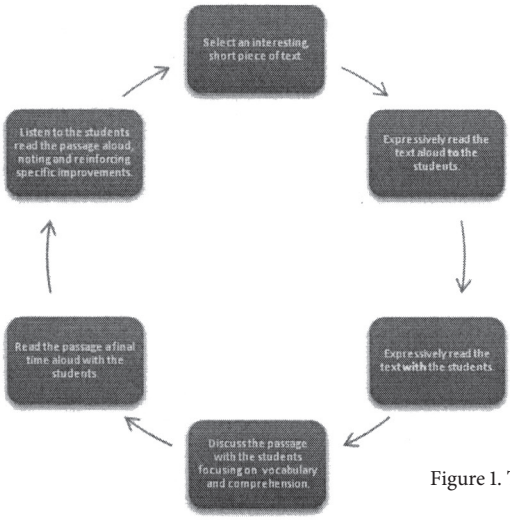

Figure 1. The Fluency Lesson—The Teacher's Role

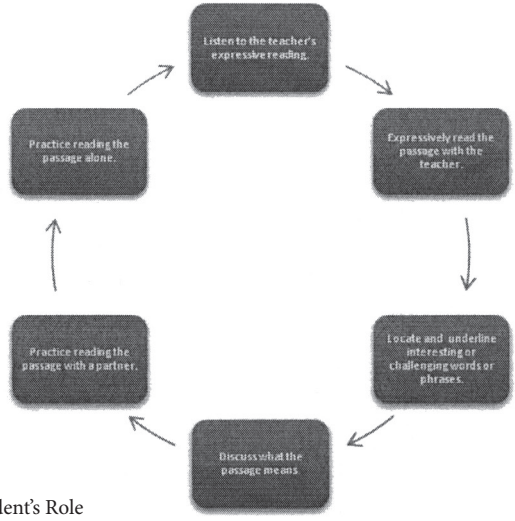

Figure 2. The Fluency Lesson—The Student's Role

Does the FDL Work?

The FDL is firmly grounded in the theoretical principle that fluent reading evolves from repeated practice, a key finding among the experimental studies on fluency reviewed and endorsed by National Institute of Child Health and Human Development (2000). Repeated readings of texts help students to read quickly, accurately, and smoothly which increases comprehension (Samuels, 1979). Repeated readings are a prominent feature in programs designed to improve fluency and the FDL is no exception as it involves daily repeated reading of short, engaging texts selected by the students or by the teacher with students' interests in mind.

The bottom line for all teachers concerned with the improvement of student reading is, "Will the FDL improve reading for my students?" Rasinski (2003) reports that when he and his research colleagues participated in a yearlong implementation of the FDL in an elementary urban setting where the students were generally struggling readers, teachers implementing the FDL consistently and with fidelity found that their students made significant achievement. Gains were noted in both reading fluency and overall reading progress when compared with the students' previous growth and in comparison to students not engaged in the FDL (Rasinski, Padak, Linek, & Sturteveant, 1994). Similarly, over a three-year period of time with middle childhood students struggling with reading, the fluency development routine enacted by the teacher resulted in gains in fluency and overall reading proficiency (Griffith & Rasinski, 2004). Likewise, in a university reading clinic setting, the FDL has become a core instructional strategy because substantial progress of middle and secondary students experiencing intense reading difficulties has been observed and reported (Rasinksi & Padak, 2005).

Additionally, as students become more confident, competent, and efficient in their own reading they begin to transfer their knowledge and skills to other reading tasks. In turn, homework assignments, classroom assessments, and state and national testing results are likely to be enhanced. Thus, the FDL holds great promise for positively influencing the educational outcomes of secondary students, including CTE students.

Fluency Development Lesson in CTE Classrooms

CTE teachers who plan to use the FDL in their classrooms can employ the following steps:

- *Assessment*. Begin with an informal reading assessment of the students who appear to be struggling. School records such as IEPs, 504 plans, as well as teacher observations are helpful here. At the most basic level,

teachers may observe that students are unable to accurately decode text. The inability to comprehend what they have read also makes the students good candidates for the FDL.

- *Reading Materials*. CTE teachers can then locate appropriate reading materials for these students. A recent growing genre of literature are texts of high interest and low readability. These reading materials provide students with easy to decode and comprehend material on topics of great interest to students of all ages. Samples of this type of text are used in later portions of this document.
- *Incorporate into Program Dimensions*. Once appropriate texts have been selected, reading instruction can be incorporated into one or all three program dimensions—CTSO, classroom and the learning lab.
- *Monitor Improvement*. Student progress should then be monitored and reading behavior documented for future lesson planning. For example, CTE teachers should observe increased reading rate, improved decoding/word recognition, enhanced comprehension, and interest and desire in reading. These are indications that students are progressing.
- *Adjust Instruction as Appropriate.* As students grow in their skills and abilities, reading instruction can be adjusted to incorporate more difficult reading materials.

There are many applications of the FDL for the CTE classroom. The following two examples indicate how the FDL might be employed in the CTE classroom. The teacher may select passages that are linked to the area of study, yet are entertaining and interesting. Other passages may be chosen from CTE textbooks or manuals. The selected examples apply to the culinary arts and the horticulture classrooms. These protocols can be used with struggling readers no matter the setting.

Education in the culinary arts focuses on developing the knowledge and skills required for students to work in a professional kitchen. The curriculum readies students to prepare meals that are pleasing to the palate, the eye and are appropriate to the dining setting. For example, students may be employed in restaurants, schools, hospitals or other institutions that have responsibility for feeding clients, students or patients. Training also includes the science of food and a thorough understanding of food safety, diet and nutrition. To master this challenging curriculum, fluency matters. Consider this excerpt from an engaging high interest, low readability passage:

> Hamburger and cheeseburger are widely used and commonly recognized names for sandwiches. The story of another sandwich is a completely different story. Sub, Submarine, Grinder, Po-Boy, Zeppelin, Hero, Hoagie, Italian sandwich, Torpedo, Dagwood and Rocket are all names that describe a particular kind of sandwich. Primarily, the sandwich con-

> sists of lunchmeat, cheese and various toppings placed on a roll shaped like a submarine. This is the only product with so many different names. First cousins to these sandwiches could be the French Dip, the Cuban sandwich and the Philly Cheese Steak since they are quite similar in ingredients and shape (O'Connor, 2010).

This particular text was chosen for several reasons. The first is because this is a food familiar to most students. In this way, the passage targets student motivation and engagement. When a student comes to a passage with some prior knowledge, it allows the student to anticipate what the text may say as well as create a foundation for new ideas. Second, the text offers the reader an introduction to new vocabulary (e.g., Grinder, Po-Boy, Zeppelin, Dagwood) and clearly and simply defines the new vocabulary.

As we have described, the FDL should begin with an expressive oral reading demonstration, followed by a second guided reading opportunity. Capitalizing on student interest, the teacher may then develop a conversation around what a term such as "first cousins" means in this context. Finally, the student might practice reading this passage as part of a menu-planning lesson or as part of a meal service.

As students work together to develop fluency, the classroom community is enhanced as students take on leadership roles related to using their new knowledge in a professional setting. As students gain confidence in their ability to read fluently, they are able to develop a specialized vocabulary that capitalizes on context clues and motivating text. Also, comprehension is deepened as the student's background knowledge is employed, and conversation about how sandwiches have different names occurs.

A second example from a horticulture text offers an illustration of the FDL in use with material from a textbook. Horticulture students study the industry and science of plant cultivation including the disciplines of plant propagation, crop production and breeding, genetic engineering and biochemistry. The curriculum is demanding and requires that students be able to read and understand scientific and technical text. An example is offered below:

> Prehistoric people were primarily hunters and gatherers; that is, they took what their environment provided for them but did not attempt to modify what nature provided. These early gatherers simply collected fruits, seeds and nuts that they found to be edible and readily available in their immediate surroundings. Subsequently, primitive people began to study plants in an early attempt to control their environment and began to adapt the environment to their advantage. First studies of plants considered practical questions.
>
> - Is it edible? Poisonous?
> - Does eating it modify well being?

- Does it taste good?
- Can it be used to combat pain or disease?

(Preece & Read, 2005, p.5).

In this example, the text provides a number of ways to engage student interest and to foster comprehension. The questions at the end allow for the teacher to engage students in a discussion about plants prior to the first expressive reading. As was noted in the culinary example, after students are equipped with background knowledge they are better able to access new material within the text. In turn, meaning is constructed and students feel less challenged as they approach new text. Additionally, this example provides the reader the opportunity to encounter and practice, common transition words (e.g., subsequently) in the content of the text. Finally, the text offers an introduction into an important theme of horticulture studies, namely the modification of the environment for the needs of mankind. As students work to read the text fluently they are developing a deepened understanding of how the field of horticulture has evolved.

Implications for Practice

There are a number of implications for those in CTE who will use the FDL to improve student reading. The following implications relate to CTE teachers, students and teacher educators.

- CTE teachers need to improve student reading comprehension so students can be better prepared to meet the demands of college, career and the workforce of the future. Much of the literature cited indicates a need for improved comprehension and thinking skills. The FDL, when properly applied, can improve reading comprehension and learning outcomes for CTE students. And, the process for implementing the FDL can be applied to any CTE program.
- Implications for students: CTE students must do their part to improve their own reading comprehension. CTE students have opportunities through the CTSO, the classroom and the laboratory to reinforce their reading and learning. The FDL engages students in each program dimension which assists them in learning the complex content taught in contemporary CTE programs.
- Implications for teachers: Teachers must be the role model and leader in their classrooms to establish a culture of literacy. The FDL and other strategies can assist CTE teachers to achieve this goal. In particular, the FDL is easy to learn and administer. This is especially important for CTE teachers who typically come into teaching from alternate pathways and have limited formal teacher education preparation.
- Implications for teacher education programs: CTE teacher educators

should incorporate reading instruction in courses and mentoring services, provide teachers a wide assortment of support/resources and assist teachers in the classroom through professional development programming. The FDL should be incorporated into CTE teacher education coursework as one tool to assist teachers in improving student comprehension.

- Little research has been done on literacy in CTE. This article demonstrates how an effective literacy teaching strategy can be applied in a CTE program.

Conclusion

Career and technical education teachers can use the FDL process as part of establishing a culture of literacy in their classrooms. Student learning is enhanced when teachers focus their instruction on both the content to be learned and the processes that professionals use in their practice (Newman & Wehlage, 1993). Traditionally, CTE has focused instructional attention on many professional practices (e.g., accuracy, safety, responsiveness, trust building, handling conflict ethically to name a few). However, readying students for the 21st century work environment relies on the student's ability to perform as trained and to continue to learn on the job. Focusing on literacy as an instructional tool prepares students for the world beyond the classroom by providing them the necessary tools to be life-long learners. In this way, professional practice is enhanced along with other academic markers of success such as graduation and post-secondary school enrollment.

However, it is not enough that CTE teachers incorporate literacy into their classrooms. Teacher educators of CTE teachers need to be aware of the ways in which they might foster literacy among their students. By incorporating the FDL into teacher training programs, prospective teachers of CTE can enter their classrooms armed with the necessary tools to enhance literacy. This article began with sobering statistics concerning the poor performance of secondary school students on comprehensive measures of literacy. The concern for the development of students ready to face the workplace is well founded. The FDL can be a tool to support CTE teachers to better prepare their students for workplace success.

References

Association for Career-Technical Education, (2009). *CTE's Role in Adolescent Literacy, ACTE Issue Brief, 1-8.* Washington, DC. Retrieved from http://www.acteonline.org/uploadedFiles/Publications_and_Online_Media/files/Literacy_Issue_Brief.pdf.

The Partnership for 21st Century Skills, (2009, December). *A Framework for 21st Century Learning.* Retrieved from www.21stcenturyskills.org.

Allington, R.L. (1983). Fluency: The neglected goal. *The Reading Teacher, 36*, 556-561.

Barton, P., (2003). Parsing the achievement gap: baselines for tracking progress. Policy Information Report of the Educational Testing Service, Princeton, NJ.

Bottoms, G. (2010). *Alternative licensure career/technical teacher induction model*. University of Louisville: National Research Center for Career and Technical Education.

Carnegie Council on Advancing Adolescent Literacy, (2010). *Time to Act: An Agenda for Advancing Adolescent Literacy for College and Career Success*. New York, NY: Carnegie Corporation of New York.

Clay, M.M. (2005). *Literacy lessons designed for individuals: Part 2 teaching procedures.* Portsmouth, NH: Heinemann.

Dudley, A.M. (2005). *Rethinking reading fluency for struggling adolescent readers.* Retrieved from: http://www.ccbd.net/documents/bb/spring2005pp16-22.pdf

Finch, C., & Crunkilton, J. (1999). *Curriculum development in vocational and technical education*, Boston: Allyn and Bacon.

Gallagher, K. (2003). *Reading reasons: Motivational mini-lessons for middle and high school.* Portland, ME: Stenhouse.

Gregg, F. (2010). *Why do we stress reading fluency?* Retrieved from http://kelareadingsystem.com/silent.aspx

Griffith, L.W., & Rasinski, T.V. (2004). A focus on fluency: How one teacher incorporated fluency with her reading curriculum. *The Reading Teacher*, 58, 126-137.

Heller, R., & Greenleaf, C. (2007). *Literacy Instruction in the Content Areas: Getting to the Core of Middle and High School Improvement*. Washington, D.C.: Alliance for Excellent Education.

Murnane, R.J., & Levy, F.(1996). *Teaching the New Basic Skills: Principles for Educating Children to Thrive in a Changing Economy.* Free Press, NY.

National Council of Teachers of English, (2006). NCTE Principles of Adolescent Literacy Reform, Urbana, IL: NCTE.

National Assessment of Educational Progress. (2005). *Reading report card for the nation and the states-2005.* Retrieved from http://nces.ed.gov/nationsreportcard/pubs/main2005/2006451.asp

National Institute of Child Health and Human Development. (2000). *Report of the National Reading Panel. Teaching children to read: An evidence-based assessment of the scientific research literature on reading and its implications for reading instruction* (NIH Publication No. 004769). Washington, DC: U.S. Government Printing Office.

Newman, F., & Wehlage, G. (1993). Authentic Learning. *Educational Leadership*. *50*(7), 8-12.

O'Connor, P. J. (2006). *The High-Performance Workforce and the At-Risk Student*. The National Dropout Prevention Network, Clemson University, Clemson, SC.

O'Connor, P.J. (2010). *America Period*. The Dennehy Foundation. Kent, Ohio

O'Connor, P.J. (2010, February). CTE Teachers as Content Area Reading Teachers. *Techniques.* 34-36. Association for Career-Technical Education, Washington, D.C.

O'Connor, P.J., Bintz, W. & Murray, R. (2009) Improving Reading for Academic Success: Strategies for Enhancing Adolescent Literacy. The National Dropout Prevention Center. Clemson, SC.

Padak, N.D., & Rasinski, T.V. (2008). *Evidence-based instruction in reading: A professional development guide to fluency.* Boston, MA: Pearson.

Park, T. (2010). *Research snapshot, authentic literacy applications in CTE: Helping all students learn*. National Research Center for Career and Technical Education: University of Louisville.

Preece, J. E., & Read, P. E. (2005). *The biology of horticulture*. Boston: Wiley & Sons.

Rasinski, T.V. (2010). *The fluent reader*. (2nd ed.). New York: Scholastic.

Rasinski, T.V. (2003). *The fluent reader*. New York: Scholastic.

Rasinski, T.V. (2004). *Assessing reading fluency*. Retrieved from www.prel.org/programs/rel/rel.asp

Rasinski, T.V. (2006). *Reading fluency for adolescents: Should we care?* Retrieved from http://www.ohiorc.org/adlit/inperspective/issue/2006-2009

Rasinski, T.V., Blachowicz, C., & Lems, K. (2006). Introduction. In T. Rasinski, C. Blachowicz, & K. Lems. (Eds.), *Fluency Instruction: Research-based best practices* (pp.1-3). New York: The Guilford Press.

Rasinski, T. & Padak, N.D. (2005). Fluency beyond the primary grades: Helping adolescent struggling readers. *Voices in the Middle*, *13*(1), 34-40.

Rasinski, T.V., & Padak, N.D. (2008). *From phonics to fluency: Effective teaching of decoding and reading fluency in the elementary school*. Boston, MA: Pearson.

Rasinski, T.V., Padak, N., Linek, W., & Sturtevant, E. (1994). The effects of fluency development instruction on urban second grade readers. *Journal of Educational Research, 87*, 158-164.

Rasinski, T.V., & Zimmerman, B.S. (2011). Fluency: The misunderstood goal of the curriculum. *School Library Journal.* Retrieved from *http://www.schoollibraryjournal.com/slj/articlereview/890260-451/story.csp*

Samuels, S.J. (2002). Reading fluency: Its development and assessment. In A.E. Farstrup & S.J. Samuels (Eds.), *What research has to say about reading instruction 3rd ed*. (pp.166-183). Newark, DE: International Reading Association.

Samuels, S.J. (1979). The method of repeated readings. *The Reading Teacher,* 32, 403-408.

Scott, J., & Sarkees-Wircenski, M. (2001). *Overview of career and technical education,* Homewood, IL: American Technical Publishers.

Stanovich, K.E. (1991). Word recognition: Changing perspectives. In R. Barr, M.L., M.L. Kamil, P. Mosenthal, & P.D. Pearson (Eds.), *Handbook of Reading Research, 2*, 418-452. New York: Longman.

Topping, K.J. (2006). Paired reading: Impact of a tutoring method on reading accuracy, comprehension, and fluency. In T. Rasinski, C. Blachowicz, & K. Lems. (Eds.), *Fluency Instruction: Research-based best practices* (pp. 173-191). New York: The Guilford Press.

U.S. Department of Education. (2005). *The Nation's Report Card: 12th Grade Reading and Mathematics* (Publication of the Institute of Education Sciences and National Center for Education Statistics).Washington, DC: U.S. Government Printing Office.

Vaites, G. (2003). Improving reading proficiency through CTE, *Techniques*, 26-30.

Publication Guidelines for the International Journal of Vocational Education and Training

The *International Journal of Vocational Education and Training* reflects regional contributions and is international in scope. Its purposes are to provide a forum for the discussion of vocational education and training issues and practices; to assist in the dissemination of information on research and practice; and to strengthen the lines of communication among individual researchers and practitioners, institutions, and organizations. In addition, it provides a platform for individual views on relevant issues.

The Editorial Board passed a resolution requiring membership in IVETA in order to publish in the Journal, with effect from Volume 14.2. The Journal publishes feature articles on research, theory, and practice broadly related to international vocational education and training. The largest section of the Journal is devoted to empirical research articles. General articles and research manuscripts submitted for publication should he between 1,200 and 5,000 words in length and should adhere to rules in the most recent edition of the Publication Manual of the American Psychological Association (APA) with the exception of placing tables in-column in the text where you prefer them to appear. Articles should deal with some relevant aspect of educational opportunity such as educational research, evaluation, instruction, teaching methods, policy making, or theoretical discourses related to education and training.

In addition, the Journal solicits book, test, and computer hard/software reviews (500-700 words) and research in brief manuscripts (800-1,200 words) with similar publication goals. Authors interested in submitting a manuscript are required to follow the APA format as noted above. Email manuscripts that conform to the required specifications to: dmupinga@kent.edu.

Style and Submission Requirements

Copies. Submit electronic copies to: ijvet@kent.edu.

Style. Adhere to the most recent APA edition to format your manuscript. Please remember the exception: Place any tables or figures in-column where they should appear. Any paper that does not otherwise follow APA style will not be considered. Make certain that documentation (reference) format rules are double-checked. In addition, avoid footnotes, and do not include your name or affiliation on any page after the title page. No more than 5% of a paper's text should be direct quotations. Insert only one space after punctuation at the end of sentences.

Tables and Figures. Tables and figures should relate directly to the content of the manuscript and should not repeat information given in the text. Please remember that the Journal publishes in black and white, not in color. When creating or saving a copy of your manuscript for Journal publication, please create tables and figures in black and white (you may need to return to your original manuscript and configure tables and figures for black and white reproduction). Figures should be provided on high-quality, glossy white paper and

should fit on one page. Tables should not exceed one page, and there should be no more than three tables per article. Also, do not place table or figure titles inside the table or figure.

General Articles and Research Manuscripts. General articles and research manuscripts must be between 1,200 and 5,000 words long, or not more than 25 typed pages (double-spaced). Authors should keep tables and figures to a minimum and include them in-column at the appropriate point(s) of insertion. Emphasis is placed particularly upon manuscripts that are research-oriented.

Cover Page and Title. Authors must include a removable cover page that is attached to each manuscript. This cover page should include the title of the manuscript and the name, address, phone number, email address, and institutional affiliation of each author. The title should be no more than 12 words.

Abstract. An abstract describing the manuscript should be included on a separate sheet. The abstract must be less than 120 words. Please follow APA guidelines when writing the abstract.

Book Reviews. Book reviews should be between 500 and 750 words in length and contain the following information: complete bibliographic entry, including cost (hard- and softcover, if available); the thesis of the book; a brief description of the argument (main ideas); sample passages quoted and/or commentary on writing style; shortcomings and strengths; intended audience (whom the book will most benefit in the international education and training community); your opinion of the book; and what you think the book contributes to the international vocational education and training community.

Test Reviews. Test reviews should be between 500 and 750 words in length and contain the following information: complete bibliographic entry, including cost; the main purpose(s) of the test; a brief description of the administration and time; shortcomings and strengths; intended audience (whom will the test most benefit in the international education and training community); your opinion of the test (citing similar tests and the pros and cons relative to those tests); and what you think the test contributes to the international vocational education and training community.

Review Process. Once your manuscript has been received, it will be checked for conformity to style and Journal requirements, then forwarded to at least three peer review readers who will read your manuscript and make recommendations as to whether to accept or reject it for publication. Unless the manuscript is inappropriate for review due to length and/or topic, manuscripts submitted to the *International Journal of Vocational Education and Training* are anonymously reviewed by a peer review reader group as noted above. You will receive a publication decision within a reasonable amount of time (normally 3 to 5 months). Do not submit manuscripts concurrently under consideration by another publication or manuscripts that were previously published. Indicate a statement on the cover page is the manuscript is being reviewed or has been submitted for publication elsewhere.

Mailing Instructions. Please include your email address if you have one. Manuscripts with requisite hard copies can also be forwarded to:

Dr. Davison Mupinga, Editor
International Journal of Vocational Education and Training
Kent State University
College of Education, Health, and Human Services
School of Teaching, Learning, and Curriculum Studies
P.O. Box 5190 412 White Hall
Kent, Ohio 44242-0001 USA
(330) 672-2656
Email: ijvet@kent.edu

Call For Papers

Currently, IJVET is accepting original manuscripts from scholars and practitioners worldwide focusing on TVET. The spring 2012 issue focuses on: Technical Vocational Education and Training (TVET) Staff Development: Meeting the Needs of the Knowledge Economy. Authors wishing to have articles reviewed and published in this volume are encouraged to submit their manuscripts by August 30, 2011 to dmupinga@kent.edu.

Please note that per current requirements, you must be an IVETA member to publish in the IVETA Journal. However, IVETA membership is easily obtained. Visit http://www.iveta.org/members/index.php/IVETA-Basics/Frequently-Asked-Questions.html for details on obtaining membership. Then click on the "Membership Application" box at the top of the page [or go to http://www.iveta.org/members/images//newmbrshipapp.2009.pdf]

Topic Areas of Interest

In general, IJVET accepts articles on all general aspects of TVET, however, the journal welcomes manuscripts that meet the general criteria of significance and scientific excellence, and will publish: original articles in basic and applied research, case studies and critical reviews, surveys, opinions, commentaries and essays including, but not limited to the following topic areas:

- Information and communication technologies and TVET
- Comparative studies in TVET
- Financing TVET
- Implementation & evaluation of TVET programs or education
- New and emerging practices in TVET
- TVET as continuing or lifelong Learning
- Transfer of Training
- Formal, Informal & Non-formal TVET
- TVET policies at local, national, and international levels
- Occupational competencies and TVET
- National Vocational Qualifications & Occupational Standards,
- Occupational Certification, Licensing & Accreditation
- Cost Effectiveness and Quality Based TVET
- Instructional methods and TVET

For guidelines on submitting manuscripts, please visit: http://www.iveta.org/members/index.php/Members-Information/IVETA-Journal-Publication-Guidelines.html

Editorial Board Members

IJVET is also seeking members willing to serve as reviewers for the journal. If you are interested in joining our team of reviewers please, send your resume to: dmupinga@kent.edu

IVETA Membership Application or Renewal

FAX: 1-651-305-9600
E-Mail: iveta@visi.com

Please Print or Type All Information!

Name_____
Last First Middle Initial

Title_____

Organization_____

Street Address_____

City_____ State_____ ZIP_____

Country_____

Telephone No._____

FAX No._____

E-Mail Address_____

Internet Address _____

You are invited to attach your business card here.

Areas of Interest (List only three)

_____
_____
_____

Areas of Expertise (List only three)

_____
_____
_____

Type of Membership (check one) ☐ New ☐ Renewal Printed Version of the Journal ($35US) ☐

Category of Membership (check one)

☐ Regular (US $50.00) Electronic per year

☐ Student (US $25.00) Electronic per year

☐ Organizations (US $300.00) per year

Organizational Members: You may contact the Executive Secretariat for information on bank transfers. This does not apply to individual memberships

The membership term one year from the time you sign up. You may pay for more than one year. Check the appropriate box below.

☐ 1 year ☐ 2 years ☐ 3 years ☐ 4 years ☐ 5 years

How did you find out about IVETA

☐ An IVETA member encouraged me to join, please give member name

_____

☐ Through the Web Site
☐ Through an IVETA conference
☐ By reading the IVETA Journal
☐ Other _____

METHOD OF PAYMENT:

Check on US Bank or Money Order. You may also pay using Western Union, MasterCard or VISA. If you use Western Union make the funds Out to the Executive Secretariat and send her the number Western Union gives you.

Amount Enclosed $_____

Send US Bank Check or money order to address below.

IVETA
186 Wedgewood Drive
Mahtomedi, MN 55115 USA
Telephone: 1-651-770-6719
FAX: 1-651-305-9600
E-Mail: iveta@visi.com

Credit Card Payment
Amount Authorized $_____

Please charge my ☐ VISA ☐ MASTERCARD

Account No._____

Expires:_____

_____
(Type or Print Name as it appears on card)
Authorizing Signature of Card Holder ***(Must be signed)***