

Characteristics of Secondary Engineering Design Graphics Educators: Three Waves of IES Data from 2007 to 2016

Thomas O. Williams, Jr.
Office of Educational Research and Outreach
Virginia Tech

Jeremy V. Ernst
Associate Dean for Research
Embry-Riddle Aeronautical University

Abstract

This proposal examined engineering design graphics educator characteristics across three waves of IES data that were weighted to approximate the population of educators and their caseloads. The findings showed that engineering design graphics educators are primarily white males who are in the middle of their careers based on age and experience. More are entering the field through alternative programs with the largest percentage having a bachelor's degree or less. Their caseloads of students with disabilities and limited English proficiency have slowly and steadily increased over time. Town and rural locations have witnessed a steady decrease in educators over time. These changes have the potential to impact the level and influence of services provided by engineering design graphics educators.

Introduction

Engineering design graphics coursework and curricula that secondary educators work to provide creates a critical foundation for promoting and supporting the development of associated engineering design competencies and abilities. Development of an engineering design graphics foundation is of particular importance to students currently studying or having the intention to concentrate study in a STEM content area at the post-secondary level (Busby, Ernst, & Clark, 2011). Given the importance, placement, and increased demand of engineering design graphics in the secondary education space, how have backgrounds and preparedness of its educators trended? Specifically, with the current state of public school learning environments and methods of instruction providing full educational access to all students, has this created unique demands on engineering design graphics educators based on learner composition?

In order to offer educational benefits that have direct application to future educational and career preparedness, classroom activities and assignments must be made accessible and meaningful to learners from all backgrounds. Even with this goal in mind, curricula and classroom structure can inhibit full access for certain learner groups within secondary engineering design graphics classrooms. Previous research (Ernst, Li, Williams, 2014) had indicated that the number of students

with special academic and behavioral needs have been increasing. It is imperative that the engineering design graphics educators keep up with these demands.

Research Questions

Employing three waves of data from the Schools and Staffing Survey Teacher Questionnaire (SASS TQ) and the National Teacher and Principal Survey (NTPS TQ) the following research questions were investigated:

1. How have the characteristics and qualifications of engineering design educators changed over time?
2. How have engineering design educator caseloads of students with disabilities and student with limited English proficiency changed over time?

Instrumentation

This study analyzed data from the 2007-2008 SASS TQ, 2011-2012 SASS TQ, and 2015-2016 NTPS TQ restricted-use data files. The SASS TQ series was conducted by the National Center for Education Statistics (NCES) on behalf of the U.S. Department of Education and provides data on the characteristics and qualifications of teachers and principals, teacher hiring practices, professional development, class size, and other conditions in schools across the nation. The NTPS TQ is a redesign of the SASS TQ and many of the questions are identical. All three are designed to produce national, regional, and state estimates for public elementary and secondary schools. A detailed analysis of the surveys can be found in Tourkin, Thomas, Swaim, Cox, Parmer, Jackson, Cole, and Zhang (2010), Cox, Parmer, Strizek, and Thomas (2016), and Taie and Goldring (2017).

Participants and Variables

In this study, the participants who gave a subject-matter code 246 (CADD and Drafting) to the question, “This school year, what is your MAIN teaching assignment field at THIS school?” were identified as engineering design graphics teachers. This resulted in 10,120; 12,240; and 14,780 teachers respectively. The demographic variables examined were gender, age, teaching experience, employment status, race, ethnicity, level of education, certification status, route to certification, urbanicity, caseload for categorical disabilities, caseload for LEP, and the service load of at-risk students. The service load of at-risk students was the combination of categorized disabilities and LEP.

Procedure

This study consisted of a secondary analysis of the two SASS TQ and NTPS TQ restricted-use datasets to present a national profile of engineering design graphics teachers across sampling time frames. Data were analyzed using SPSS 23.0. All data presented were weighted. All *N*'s were rounded to the nearest 10 per NCES requirements.

Gender, Age, Teaching Experience, and Employment Status

Demographic information concerning gender, age, teaching experience and teaching status is presented in Table 1. Engineering design graphics teachers were predominately male and full-time teachers. Their mean age and mean teaching experience suggested that these teachers were in the middle of their expected teaching careers.

Table 1. Engineering design graphics teacher demographics according to gender, age, teaching experience, and employment status.					
	Male	Female	Mean Age in Years	Mean Experience In Years	Full-time Status
SASS 2007-08 (N = 10,120)	93.1%	6.9%	47.37	12.59	95.7%
SASS 2011-12 (N = 12,240)	93.7%	6.3%	48.12	14.74	97.1%
NTPS 2015-16 (N = 14,780)	88.5%	11.5%	49.06	14.65	94.4%

Race and Ethnicity

Teachers' self-reported race and ethnicity is presented in Table 2. Racial category descriptors are presented verbatim as they appeared on the surveys. Participants were allowed to make more than one selection. Data for certain descriptors did not meet IES and NCES reporting standards and were not presented in the tables. The most prevalent self-selected racial category represented was White, with a decrease in Black or African Americans overtime and slight increase in Hispanics.

Table 2. Percentage of engineering design graphics teachers self-reported racial and ethnic categories.						
	Hispanic	White	Black or African American	Asian	Native Hawaiian or Other Pacific Islander	American Indian or Alaska Native
SASS 2007-08	1.2	90.1	8.0	*	*	*
SASS 2011-12	4.2	89.8	3.1	*	*	*
NTPS 2015-16	5.7	94.1	5.3	*	*	*
Note. * Did not meet IES reporting requirements						

Location

The location of engineering design graphics teachers was examined through urbanicity: city, suburban, town, and rural. There has been an increase in city and suburban locations and a decrease in town and rural locations over time.

	City	Suburban	Town	Rural	
SASS 2007-08	12.4	36.3	20.1	31.2	
SASS 2011-12	21.0	30.1	13.3	35.8	
NTPS 2015-16	24.8	40.6	12.8	21.8	

Level of Education

Table 4 shows the highest level of education that was reported. The bachelor's degree tended to be the most prevalent degree along with a large percentage of teachers who have an associate degree while those with masters and doctorate declining over time.

	Associate	Bachelors	Masters	Educational Specialist	Doctorate
SASS 2007-08	28.7	34.1	30.0	2.3	4.8
SASS 2011-12	30.2	37.5	24.0	5.3	5.1
NTPS 2015-16	32.5	39.9	21.7	4.9	0.9

Certification Status, Route, and Qualification Status

Table 5 shows the certification status, certification route, and qualification status of engineering design graphics teachers. The percentage with state certification has remained somewhat stable over time while those pursuing certification are increasingly doing so through an alternative certification program as career program entry.

	Regular or standard state certificate	Alternative certification program	Traditional certification program
SASS 2007-08	74.2	39.8	60.2
SASS 2011-12	81.0	34.6	65.4
NTPS 2015-16	75.5	49.5	50.5

Caseloads

The caseloads of students with categorized disabilities, limited English proficiency (LEP) and at-risk service load are shown in Table 6. Over time, there has been a small but steady increase in students with categorical disabilities, students with LEP, and the at-risk service load.

	Mean Categorical	Mean LEP	Mean At-Risk Service Load
SASS 2007-08	9.56; <i>SD</i> =8.59	3.19; <i>SD</i> =11.01	12.74; <i>SD</i> =13.61
SASS 2011-12	12.45; <i>SD</i> =10.75	3.58; <i>SD</i> = 10.06	16.03; <i>SD</i> = 19
NTPS 2015-16	11.81; <i>SD</i> = 12.90	3.42; <i>SD</i> =12.99	15.23; <i>SD</i> = 19.21
Note. <i>SD</i> is Standard Deviation			

Conclusions and Implications

Over the past decade, there has been a slow but steady increase in the caseloads for engineering design graphics teachers for students with categorical disabilities and LEP. The results of the current study highlight that 32.5% of engineering design graphics teachers have an associate's degree as their highest level of education and approximately 40% have a bachelor's degree. Approximately 50% of these teachers chose alternative routes to certification. This combination of education and routed to certification could potentially have an adverse effect on the knowledge and skill sets necessary to successfully to teach students with categorical disabilities and LEP.

References

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