Mechanical Aptitude of Post-Secondary Agricultural Education Majors

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Introduction

Understanding a future employee's aptitude for understanding and applying mechanical principles helps future employers make hiring decisions. Many organizations use testing as a component of their employment selection process (Bennett, 1994). The ability to comprehend mechanical principles is an important skill within the field of agricultural education and is a content area we regularly see taught within the agricultural education curriculum, both at the secondary and post-secondary levels (Lawver, 1992; Saucier & Krysher, 2014). Testing of these skills allows educators and employers to measure the extent to which students or employees have mastered mechanical comprehension. This also helps to identify who needs more training.

Previous studies of differences in mechanical comprehension found that males usually perform better than females (Lunneborg & Lunneborg, 1985; Sapitula & Shartzer, 2001). Of those who received bachelors in general agriculture in 2012, 48% were female, while in agricultural education there were more females than males. We find an even larger divide when we look at the 12% of females who completed an undergraduate degree in engineering (National Center for Education Statistics, 2014). It is important that agricultural education majors have a level of mechanical aptitude to be successful in their future careers.

Framework

The purpose of this study was to determine the mechanical comprehension level of undergraduate agricultural education majors using the Bennett Mechanical Comprehension Test (BMCT) (Bennett, 1994). The theoretical framework for this study was based around the theory of planned behavior (Azjen, 1985), the theory of planned behavior was designed to exhibit the relationship between informational and motivational influences on behavior (Connor & Armitage, 1998).

Methods

The purpose of the BMCT is to measure the ability to perceive and understand the relationship of physical forces and mechanical elements in practical situations (Bennett & Cruikshank, 1942). The BMCT is an aptitude test and functions differently from an achievement test. Aptitude is used to measure a person's ability for future reasoning and acquisition of knowledge (Ransdell, 2001). The BMCT is composed of 68 items that are illustrations of simple, frequently encountered mechanisms. For each question the participant reads a prompt, examines an illustration and chooses the best answer from three choices. The Flesch-Kincaid formula indicates readability at the sixth-grade level. Previous studies have shown strong support for the validity of the BMCT (Kolz, McFarland & Silverman, 1998; Muchinksy, 1993) and reliability resulted in a Cronbach's alpha of 0.71.

The BMCT was administered to college agricultural education students currently taking an introduction to agricultural mechanics course. The range of scores possible for the BMCT is 10 – 90. The raw scores students received were recorded and compared between demographic characteristics. We also compared raw scores within percentile rank scores of various professions. Students in this study (n = 30) ranged in grade level from Freshmen (n = 2, 7%), Sophomores (n = 6, 20%), juniors (n = 15, 50%) and Seniors (n = 7, 23%). Students identified themselves as Caucasian (n = 21, 70%) and Hispanic (n = 9, 30%). Due to the nature of this

study, caution should be taken when generalizing the findings or when making inferences beyond the sample population.

Findings

The mean of the participants BMCT scores was 43 (*SD* = 7), ranging from 29-56 (see Table 1). In comparison to the BMCT normative data, the undergraduate participants' scored higher than heavy equipment operators (*M* = 24.1, *SD* = 9.4); their BMCT scores were lower than the other professions' normative data.

Table 1
Participants' Scores Compared to BMCT Normative Data

Group	*M*	*SD*
Engineer	52.1	9.0
Welder	47.4	8.9
Automotive Mechanic	46.0	11.0
Heavy Equipment Operator	42.1	9.4
Undergraduate Participants	43.0	7.0

In regard to the demographic characteristics of the participants, male students (*M* = 45.71, *SD* = 5.4) earned higher BMCT scores in comparison to female students (*M* = 36.61, *SD* = 6.5)(See Table 2). Among grade classification, freshmen (*M* = 52.50) earned the highest BMCT scores.

Table 2
BMCT Scores by Demographics

	f	*M*	*SD*
Gender			
Male	21	45.71	5.4
Female	9	36.61	6.5
Grade Level			
9^{th}	2	52.50	0.70
10^{th}	6	44.83	5.56
11^{th}	15	41.27	6.05
12^{th}	7	42.43	9.25

Conclusions & Recommendations

The participants were found to have a moderate level of mechanical comprehension. The BMCT scores varied but no pattern was found in between the mechanical comprehension and students' grade classification. To increase the BMCT scores, it is recommended that the secondary students receive more technical education at the secondary and post-secondary level, to prepare them to effectively teach agricultural mechanics. Male students had a higher level of mechanical comprehension in comparison to female students, consistent with previous studies (Forston, 1991; Sapitula & Shartzer, 2001). To create a source of comparison, the BMCT instrument should be administered to secondary students enrolled in higher-level agricultural mechanics courses, to see if their mechanical comprehension levels increase with more experience in agricultural mechanics courses.

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