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SHORT PAPER

Characteristics of Effective Teaching: Two-Year Technical College Students' Perspective

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ABSTRACT

Teaching significantly influences learning. The elements of effective teaching have been thoroughly studied at the secondary and tertiary levels. Still, the literature on the components of effective teaching in two-year technical colleges is limited. Thus, the study aimed to characterize effective teaching from two-year technical college students' perspective. The study was conducted in 10 two-year technical colleges in Israel. Six hundred and seventy-four electronics students participated in the research. Three hundred and twenty-nine of the participants were younger students, who had continued to post-secondary studies directly from high school, and the remaining 345 participants were older students, who had resumed their studies after taking a break. All participants filled out an anonymous five-level Likert-like scale and answered open-ended questions. The findings indicate that both groups of students place high importance (i.e., a mean score higher than 4.00) on content knowledge, pedagogical knowledge, pedagogical content knowledge, and knowledge of learners. However, a significant difference was revealed, in favor of the younger students, in the importance attributed to knowledge of learners. This gap highlights the importance that these students attach to the relationship with the teaching staff.

KEYWORDS

effective teaching, two-year college students, electronics

1 INTRODUCTION

According to the literature, the quality of teaching has a profound impact on learning. Among other things, it affects students' motivation and academic achievements [1]. Thus, many studies have analyzed the characteristics of effective teaching in high school [2] and academia [3]–[4]. However, research on effective teaching in two-year technical colleges is sparse.

Two-year technical colleges offer programs that focus on the practical side of various professions, such as architecture, biotechnology, and electronics [5]. Such programs are available in many counties, both in Europe [6] and America [7].

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Although the students generally have relatively low academic ability, upon graduation they play an important role in many industries [8].

In light of the above, the study aimed to characterize effective teaching from the viewpoint of two-year technical college students majoring in electronics. Specifically, the study examined the importance that younger and older students attribute to different types of knowledge required for effective teaching.

The paper reviews main characteristics of effective teaching, particularly at the post-secondary level. The purpose of the study and the methodology used are presented. Finally, the main findings are discussed.

2 CHARACTERISTICS OF EFFECTIVE TEACHING

Many factors affect learning. Some depend on the learner's characteristics, e.g., cognition and metacognition. Others depend on the learning environment, such as class size, classroom climate, and teaching quality. According to the literature, the latter has a profound impact on learning [1].

The complexity of the teaching process requires an effective teacher to possess both personality traits, namely, a passion for teaching, creativity, and flexibility [9], as well as several types of knowledge [10]. Scholars argue that teachers should have relevant academic knowledge, broad knowledge of the teaching profession, and knowledge of the students [11]. Similarly, studies conducted at the post-secondary level, point to the importance of content expertise, professionalism in teaching, and focus on learners, with a particular emphasis on respectful dialogue with students [12]–[13]. Table 1 lists some characteristics of effective teachers, taken from the latter studies.

Table 1. Characteristics of effective teachers (post-secondary level)

Knowledge Area	Characteristics
Content expertise	• Demonstrates proficiency in the content area
Professionalism in teaching	• Teaches in an organized and clear manner • Connects learners' prior knowledge with new content • Uses a variety of teaching methods • Possesses high communication skills
Focus on learners	• Adapts teaching to students' needs • Accessible during and outside of class • Respects students

The American Accreditation Board for Engineering and Technology (ABET) states the characteristics required of effective lecturers at two-year technical colleges [14]. According to ABET, faculty members should have both relevant education and experience, as well as knowledge of the teaching profession (refer to Table 2).

Table 2. Characteristics of effective teachers (ABET)

Characteristic	Description
Education	Demonstrates theoretical and practical knowledge in the discipline
Professional experience	Has relevant experience in the industry
On-going professional development	Stays up-to-date with professional innovations in the discipline
Professional contribution	Contributes to the discipline
Teaching effectiveness	Uses a variety of teaching methods effectively
Communication skills	Communicates effectively

In his seminal work, Shulman defined the knowledge base of teaching as several types of knowledge essential for effective instruction [15]. The seven types of knowledge are detailed below:

- Content Knowledge, hereinafter CK
- General Pedagogical Knowledge, hereinafter PK
- Pedagogical Content Knowledge, hereinafter PCK
- Curriculum Knowledge
- Knowledge of Educational Contexts
- Knowledge of Learners, hereinafter LK
- Knowledge of Educational Purposes and Values

While CK refers to proficiency in the subject being taught and PK deals with general learning theories and teaching methods, PCK refers to learning theories and teaching methods specific to the subject. Thus, PCK can be interpreted as an intersection between CK and PK (see Figure 1). Shulman even noted the special importance of PCK as distinguishing the pedagogue from the content expert [15].

Over the years, the above-mentioned knowledge base has undergone modifications. For example, another type of knowledge has been added: technological knowledge. This knowledge refers to the teacher's ability to integrate technology tools in instruction [16]. In addition, inspired by the generic knowledge base, models have been developed to characterize the knowledge needed in teaching specific subjects, such as mathematics [17].

Despite the changes, the knowledge base of teaching (and especially its CK, PK, PCK, and LK components) has constituted the theoretical framework for many studies dealing with the knowledge required of teachers in general and of effective teachers in particular [18]. Therefore, it served as the theoretical framework for this study.

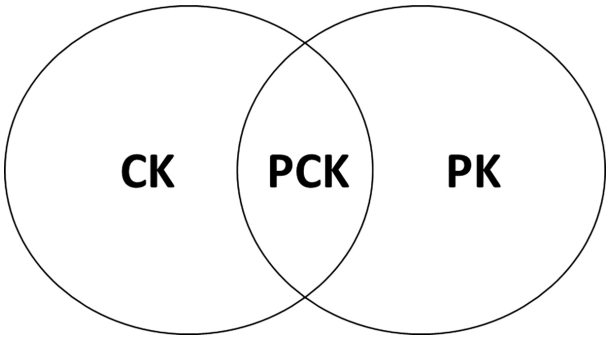

Fig. 1. Content knowledge (CK), pedagogical knowledge (PK), and pedagogical content knowledge (PCK)

3 RESEARCH GOAL AND QUESTIONS

The study aimed to characterize effective teaching from the viewpoint of two-year technical college students majoring in electronics.

The research questions were:

- What importance do younger students assign to the different types of teacher knowledge?
- What importance do older students assign to the different types of teacher knowledge?

4 METHODOLOGY

4.1 Participants

The study was conducted in 10 two-year technical colleges in Israel. Six hundred and seventy-four electronics students (second year of study) participated in the research. Three hundred and twenty-nine of the participants were younger students, who had continued to post-secondary studies directly from high school, and the remaining 345 participants were older students, who had resumed their studies after taking a break (refer to Table 3). Ethical approval was obtained from the institutional review board (permit # 2020–009).

Table 3. Participants

Group	N	Age	Gender
Younger students	329	19–20	88% male; 12% female
Older students	345	25–30	90% male; 10% female

4.2 Method and instruments

All participants filled out an anonymous Likert-like scale. This questionnaire consisted of 12 statements reflecting the major aspects of teacher knowledge mentioned earlier, i.e., CK, PK, PCK, and LK, and was based on the characteristics of effective teaching [12]–[14]. This five-point tool, ranging from "strongly disagree" to "strongly agree," was adapted to the participants' background. Two engineering education experts and three faculty members validated that the statements expressed the relevant elements of teacher knowledge. Additionally, three students, who did not take part in the study, confirmed that the statements were understandable. As for reliability, acceptable internal consistency was demonstrated for the entire questionnaire ($\alpha = 0.85$) and its four subscales ($0.63 \leq \alpha \leq 0.72$). Sample items and Cronbach's alpha values are given in Table 4.

Based on the data collected, CK, PK, PCK, and LK indices were calculated as the arithmetic mean of the scores of the relevant statements. Then, the mean score and standard deviation of the entire questionnaire were obtained. Since the assumption of homogeneity of the variance-covariance matrices was violated, MANOVA was not performed. Instead, *t*-tests with Bonferroni correction were conducted.

In addition, the participants answered open-ended questions dealing with characteristics of effective teaching. The qualitative data underwent directed content analysis, conducted by two experts in engineering education. The major types of teacher knowledge served as the theoretical framework for the analysis.

Table 4. Closed-ended scale (sample items)

CK ($\alpha = 0.63$)	PK ($\alpha = 0.72$)	PCK ($\alpha = 0.72$)	LK ($\alpha = 0.71$)
An effective electronics teacher should be knowledgeable about the subject he/she is teaching.	An effective electronics teacher should present the learning material clearly.	An effective electronics teacher should provide solutions to the difficulties unique to the subject he/she teaches.	An effective electronics teacher should get to know his/her students.
An effective electronics teacher needs to stay up-to-date on issues related to the subject he/she teaches.	An effective electronics teacher should prepare fair tests.	An effective electronics teacher should provide practical examples related to the subject he/she teaches.	An effective electronics teacher should be attentive to the students.

5 FINDINGS

Figure 2 and Table 5 present the values of the four indices (mean $1 \leq M \leq 5$ and standard deviation SD). It is clear that all indices are high for both groups. *t*-tests with Bonferroni correction ($\alpha = 0.0125$) indicate a significant difference in the LK index ($t = 2.68$, $p < 0.01$) and the absence of significant differences in the CK index ($t = 0.79$, $p > 0.05$), the PK index ($t = 1.36$, $p > 0.05$) and the PCK index ($t = 1.00$, $p > 0.05$). The significant difference is in favor of the younger students and accompanied by a small effect size ($d = 0.21$).

No significant difference ($t = 1.80$, $p > 0.05$) was detected between the overall mean importance score of the younger students (M = 4.59, SD = 0.38) and that of the older students (M = 4.53, SD = 0.48). Typical students' responses to the open-ended questions are given in Table 6.

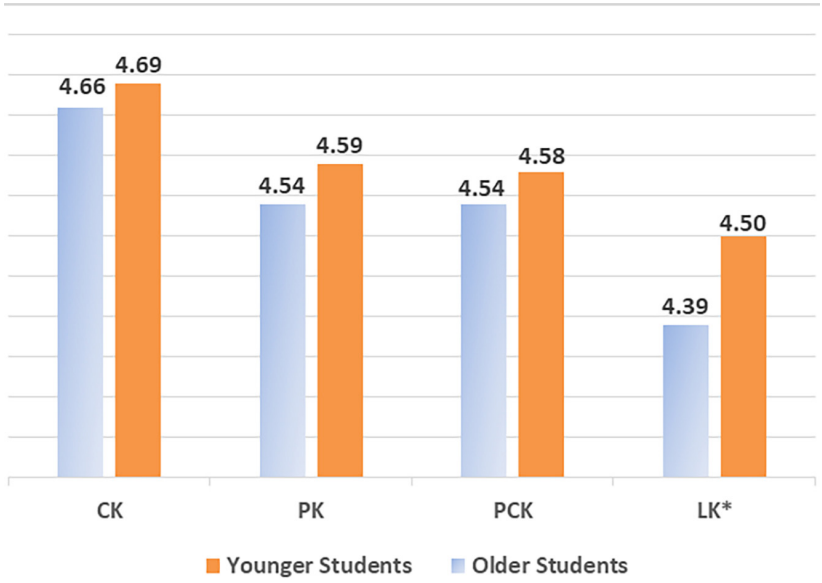

Fig. 2. CK, PK, PCK, and LK indices (means)

Table 5. CK, PK, PCK, and LK indices (means and standard deviations)

Group	CK		PK		PCK		LK*	
	M	SD	M	SD	M	SD	M	SD
Younger students	4.69	0.44	4.59	0.42	4.58	0.48	4.50	0.47
Older students	4.66	0.54	4.54	0.53	4.54	0.56	4.39	0.59

Note: $^*p < 0.01$.

Table 6. Open-ended questions (typical responses)

CK	PK	PCK	LK
An effective electronics instructor must remain professionally up-to-date. The teacher must continue to delve deeper into the topics he or she teaches.	An effective electronics lecturer should know how to present the material in the best way he or she can. A lecturer who does not write everything down clearly can make it difficult to understand the material being taught.	Electronics is a complex field, so if the lecturer understands where the difficulties lie and helps students overcome them that is great.	Naturally, students are different. Therefore, an effective electronics teacher needs to take into account that one student's understanding may be faster or slower than another.

6 DISCUSSION AND CONCLUSION

Both younger and older electronics students assign high importance, namely, a mean score higher than 4.00, to content knowledge, pedagogical knowledge, pedagogical content knowledge and knowledge of learners. These results are consistent with previous findings reported in the context of undergraduate studies [12], [19]. Thus, despite the considerable difference in academic ability between two-year technical college students and undergraduate students [5], both value the same facets of teacher knowledge.

Although no significant difference was found between the overall mean importance score of the younger students and that of the older students, a significant gap was identified in the importance attributed to knowledge of learners. This gap (small effect size) was in favor of the younger students, and might be explained by the maturity of the older students. It seems that the connection with teachers is less important to the latter students, who, unlike the former, experienced other things besides learning (e.g., work) after finishing high school.

Therefore, when teaching relatively young students (at the age of 20), instructors are advised to take into account the significance that these learners assign to the relationship with the faculty. Specifically, lecturers are encouraged to remember students' names, be attentive and accessible, express empathy, and create an atmosphere of trust. These actions support students' need for relatedness, and hence foster their intrinsic motivation, which is especially essential in technical fields [20].

The main limitation of the study is its focus on only one program offered at two-year technical colleges. Still, due to the large number of participants and institutions involved, the research makes a substantial contribution. The study's contribution lies in characterizing, for the first time, as far as the authors are aware, effective teaching from two-year technical college students' perspective. This contribution is validated in view of the meager literature on this subject and the impact of teaching on learning. Next, the authors will explore the elements of effective teaching from faculty members' viewpoint and compare the results to those obtained in this study.

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