

# Quantitative Analyses about Market- and Prevalence-Based Needs for Adapted Physical Education Teachers in the Public Schools in the United States

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## Abstract

*The purpose of this study was to analyze quantitative needs for more adapted physical education (APE) teachers based on both market- and prevalence-based models. The market-based need for more APE teachers was examined based on APE teacher positions funded, while the prevalence-based need for additional APE teachers was analyzed based on students requiring APE services. All relative data available in The 27th Annual Report to Congress (USDE, 2007) and a national APE job survey (Kelly & Gansneder, 1998) were used. Results indicate that 640 more qualified APE teachers are needed to fill out all the APE positions currently funded (a shortage of 9.15%) and 20,087 more qualified APE teachers are required to meet needs by all the students requiring APE services (a shortage of 75.96%), resulting in a substantial difference of 19,447 additional APE teachers with full certifications needed between the prevalence- and market-based models (a shortage difference of 66.81%). Implications of these results are discussed in this article.*

With the enactment of the Education for All Handicapped Act (now the Individuals with Disabilities Education Act), physical education services, specially designed if necessary, must be made available to every student with a disability receiving a free and appropriate public education (Federal Register, Au-

gust 23, 1977; Sherrill 2004). This enactment has resulted in many persons entering the adapted physical education (APE) job market over the years. The shortage of the qualified APE professionals, however, has still been a critical issue since 1975. This issue has been documented in the research focusing on the need for more college APE professors and the need for more school APE teachers (Zhang & Chen, 2004).

The need for more APE professors at colleges and universities has been investigated in a series of studies (Dunn & McCubbin, 1991; Zhang, Joseph, & Horvat, 1999; McCubbin & Dunn, 2000; Zhang, 2007). These studies, using *The Chronicle of Higher Education* as the data source, revealed that the number of APE position openings at colleges and universities has been linearly increased between years 1981-1989 (Dunn & McCubbin, 1991), 1991-1998 (McCubbin & Dunn, 2000), 1975-1997 (Zhang, Joseph, & Horvat, 1999), and 1975-2005 (Zhang, 2007). The increase of these APE professor position openings implies that additional school APE teachers are needed since a primary responsibility by APE professors is to prepare APE teachers for public schools.

Zhang and Chen (2004) investigated marketable features of the APE employment career in the public schools. This study employed *Annual Reports to Congress* by the U.S. Department of Education since 1979 (e.g., USDE, 1998) as the data source. Its results revealed that although more APE teach-

ers have been hired in the public schools over the years, the shortage of qualified APE teachers has existed in this employment market. It documented that a yearly mean of 403 APE teacher positions have been filled out by individuals without full APE certifications or left vacant from 1984 to 1996 across all states in the nation (Zhang & Chen, 2004). This shortage reflected a market-based need for additional APE teachers since it was calculated based on the number of APE teacher position openings funded.

The market-based need for additional APE teachers is driven primarily by APE positions funded (Boe, 1990; Zhang, Kelly, Berkey, Joseph, & Chen, 2000). This need is estimated by the difference between the number of employed APE teachers who are fully certified and the number of funded APE positions left vacant plus filled by persons who are partially uncertified (Parshall, 1993; Zhang et al., 2000). This difference indicates that the market-based need for APE teachers is confounded by funding. Therefore, APE teacher positions will decrease if funding is reduced regardless of the need of the student population (Sattler & Sattler, 1985; USDE, 1989), implying that the need for additional APE teachers should be estimated based on the student population.

The prevalence-based need is used to estimate the number of more APE teachers needed based on the student population. It is driven primarily by the number of students requiring APE services, and therefore is not dependent on the number of funded APE teacher positions (Sattler & Sattler, 1985; USDE, 1989; Zhang et al., 2000). This prevalence-based need is determined by dividing the number of students requiring APE services by the APE student-teacher ratio and then subtracting the number of fully certified APE employed (Boe, 1990; Parshall, 1993; Zhang et al., 2000). This is guided by the zero-reject and zero-fail assumptions that each student with disabilities

must have access to free and appropriate special education services (USDE, 1996).

Zhang and his colleagues (2000) completed a study focusing on the prevalence-based need for more APE teachers. This study derived three types of data from the *20th Annual Report to Congress* (USDE, 1998) and a national APE job survey (Kelly & Gansneder, 1998). They are (a) the number of students enrolled in the schools, (b) 4% of the school population required APE services, (c) 104:1 being as the overall national APE student-teacher ratio, and (d) the number of qualified APE teachers employed. Based on these prevalence-related data, this study estimated a total of 22,116 additional APE teachers needed to meet the needs by all students requiring APE services enrolled in the public schools in 1998 across all states in the nation.

It is clear that the prevalence-based need for 22,116 more APE teachers in 1998 found in Zhang and his colleagues' study (2000) is significantly different from the market-based need for 403 additional APE teachers estimated per year in Zhang and Chen's study (2004). Based on the results from these two studies, however, the answers to several questions have not been obtained from the APE research yet. Does the similar need for more qualified APE teachers based on the market-based model exist in the current year? Does the similar need for additional qualified APE teachers based on the prevalence-based model exist in the current year? Are there any differences between these two types of needs in the current year? A quantitative study focusing on these two types of needs is thus required in APE research. The purpose of this study was to analyze (a) the market-based needs for additional APE teachers, (b) the prevalence-based needs for more APE teachers, and (c) the differences between the market-based and prevalence-based needs using the latest data available in the literature.

## Method

### Data Sources

Two data sources were used in this study. The first source was the 27th Annual Report to Congress (USDE, 2007). This report summarizes data on the implementation of the Individuals with Disabilities Education Act as reported and updated by each of the states as of July 31, 2004 (USDE, 2007, p. 277). This data source is the latest data available and considered to be the most reliable data source of special education (McLeskey, Henry, & Hodges, 1999). Specifically, the specific data in Table 3-3 (USDE, 2007, p. 227) and Table C-1 (p. C-1) in this report were used, including (a) total APE teachers hired, (b) fully certified APE teachers employed, (c) not fully certified APE teachers hired, and (d) numbers of resident children in school year 2002-03. These data were used since they were the latest data available.

Based on *Data Dictionary* developed by the Office of Special Education Programs of the U.S. Department of Education for the 27th Annual Report to Congress (Westat, 2005), the term *fully certified* are qualified personnel (p. 46) who “hold appropriate certification and licensure for the position held;” who are “in personnel categories that do not require certification and licensure if the staff meet existing state standards or requirements for the position they hold;” and who are “staff in positions for which no state requirement exist.” The term *not fully certified* are defined as unqualified persons (p. 72) who “were employed on an emergency, provisional, or other basis and who do not hold standard state certifications or licensures for the position to which they are assigned or do not meet other existing state requirements for the position” they are holding. The term *estimated resident children* refer to “population data for 2002 and 2003” from the source of “U.S. Bureau of the Census” (p. C-1). The term *APE teachers* used in this study can be defined as an individual (p.

84) “who is certified by the *State Education Agency* to provide special physical education, adaptive physical education, movement education, or motor development to children and youth with disabilities.”

The second data source was the article entitled *Preparation and Job Demographics of Adapted Physical Educators in the United States* (Kelly & Gansneder, 1998). It provides data from a national job survey of practicing APE teachers conducted by the National Standards for APE Project funded by the U.S. Department of Education. In this survey, 575 APE teachers in the 50 states were proportionally sampled based on each state’s population size. The survey return rate was 62%. This article is the latest data-based study in which useful demographics of the APE teachers are available. Two values in the Kelly and Gansneder’s article were used in this study: (a) 4% of the school population was reported to require APE services and (b) the APE student-teacher ratio was 104:1 (i.e., caseload).

According to Kelly and Gansneder (1998), all APE teachers in the survey were asked to report the total student enrollment and the actual number of students they served in each school. Through analysis of these data, Kelly and Gansneder (1998) estimated that 3-5% of the school population would have disabilities requiring APE services. In reporting the number of students served, all APE teachers in the survey were required to distinguish between direct and indirect services they provided. The results indicated that on average, an APE teacher provided direct services to 70 students and indirect services to 34 students. This translates into a 104:1 caseload for the average APE teacher.

### Market-Based Calculation Model

The market-based calculation model was used to determine the need for additional APE teachers in the public schools based on the number of APE positions funded in each of the states across the nation (Zhang & Chen,

2004; Zhang, 2005). This model is conceptualized as  $Pm = (N / T) \times 100$ , wherein  $Pm$  refers to (P)ercent of the shortage of APE teachers based on the number of positions funded,  $N$  is (N)ot fully certified APE teachers, and  $T$  refers to the total numbers of funded APE positions, including both the number of fully certified APE teachers and the number of not fully certified APE teachers. This model is a simple model used to determine the need for the number of qualified employees based on the number of positions funded in the corresponding job market (Zhang, 2005).

For consistency with *Data Dictionary* (Westat, 2005, p. 46), *fully certified APE teachers* were defined as physical educators who met one or more of the following criteria: (a) held state APE certifications, (b) met state APE requirements, and/or (c) had APE positions for which no state APE requirements existed. The concept of *fully certified* therefore is shaped by employment practices. The reason for using the term *fully certified* in this study was that this term was used in the *27th Annual Report to Congress* (Table 3-3, USDE, 2007, p. 227). In this table, we obtained specific values of  $T$  and  $N$  required in the market-based calculation model.

### Prevalence-Based Projection Model

The prevalence-based projection model was used to analyze the need for more teachers in the public schools based on the number of students with disabilities who need APE services in each of the states in the nation (USDE, 1996, Zhang et al., 2000; Zhang, 2005). The assumption of this model was that all the students with disabilities recognized to have APE needs must receive APE services (i.e., zero reject and zero fail, Sherrill, 1998; USDE, 1996). Thus, the formula used in this model was  $Pp = [(S / R - F) / (S / R)] \times 100$ , wherein  $Pp$  refers to (P)ercent of the shortage of APE teachers based on the number of students with disabilities needing APE services,  $S$  is (S)tudents requiring APE services,  $R$  re-

fers to (R)atio of an APE teacher and APE students, and  $F$  is (F)ully certified APE teachers employed.

The number of students requiring APE service enrolled ( $S$ ) was estimated for each state by multiplying the number of estimated resident children ages 3-21 by 4%. The number of the estimated resident children in each of the states was derived from Table C-1 that notes updated population counts by a state from the U.S. Bureau of the Census (USDE, 2007, p. C-1). The 4% was a median of the 3-5% of the student population requiring APE service reported by Kelly and Gansneder (1998). The APE student-teacher ratio ( $R$ ) employed in the projection for each state was 104 as determined by Kelly and Gansneder (1998). The variable of  $R$  is thus the mean APE student-teacher ratio across all states in the United States. The number of fully certified APE teachers hired ( $F$ ) employed in each state was derived from Table 3-3 (USDE, 2007, p. 227). These values were reported by each state to the Office of Special Education Programs of the USDE and represent the actual number of fully certified APE teachers employed in a state.

As implied above, the APE student-teacher ratio of 104 was employed in projections for all states. The rationale for this use was twofold. First, there were no other ratio data available for all states. Second, this ratio provided a measurement criterion for the state-to-state comparisons of the need for APE teachers. The use of different ratios to project the need for APE teachers for different states would make the comparisons across all states impossible to interpret. It should be also noted that, the  $(S / R)$  included in the formula,  $Pp = [(S / R - F) / (S / R)] \times 100$ , refers to the total number of the needed APE teachers estimated based on the number of students who require APE services and the  $(S / R - F)$  is the total number of the shorted APE teachers estimated based on the number of students who require APE services in a state.

### Data Analyses

Three steps were followed to analyze the data. First, the market-based need for additional fully certified APE teachers was analyzed based on the market-based calculation model,  $Pm = (N / T) \times 100$ . Next, the prevalence-based need for more fully certified APE teachers was calculated based on the prevalence-based projection model,  $Pp = [(S / R - F) / (S / R)] \times 100$ . The difference between the market-based and the prevalence-based needs (i.e.,  $Pm - Pp$ ) was finally examined. These analyses are calculated in each state first and then summarized across all the states as the national level. It should be noted that Connecticut, Delaware, Nebraska, New Mexico, Texas, and District of Columbia were excluded in data analyses because their data were not available in the data source selected in this study.

### Results

Table 1 presents results based on the purposes proposed in this study. Columns 2, 3 and 4 reveal information about the market-based needs for additional fully certified APE teachers. The data taken from the data sources are presented in Columns 2 and 3. The percentages of shortage calculated based on the formula of  $Pm = (N / T) \times 100$  for each state were presented in Column 4. The second column shows the total numbers of the APE teachers employed or the APE teacher positions funded ( $T$ ), while the third column presents the numbers of the not fully certified APE teachers employed or additional APE teachers needed ( $N$ ). These data were taken from Table 3-3 published in the *27th Annual Report* (USDE, 2007). The fourth column indicates the percents of APE teacher shortages based on the market-based calculation model ( $Pm$ ). The summarized data at the national level are presented in the last row of Columns 2-4.

Columns 5-7 show information about the prevalence-based need for more fully certified

APE teachers. The data used in calculating the prevalence-based need are shown in Columns 5 and 6, while the percentages of APE teacher shortages calculated based on the formula of  $Pp = [(S / R - F) / (S / R)] \times 100$  are presented in Column 7. The fifth column indicates the numbers of fully certified APE teachers estimated ( $S / R$ ) by dividing the numbers of children requiring APE services ( $S$ ) by an APE teacher-student ratio of 104 ( $R$ ). The sixth column shows the numbers of more fully certified APE teachers needed ( $S / R - F$ ), in which  $F$  stands for the number of fully certified APE teachers hired. The seventh column presents to the percentages of APE teacher shortages based on the prevalence-based model ( $Pp$ ). The summarized data at the national level are shown in the last row of Columns 5-7.

Columns 8 and 9 shows information about the shortage difference between the market-based needs for additional fully certified APE teachers and the prevalence-based needs for more fully certified APE teachers. Those data presented in the eighth column indicate the differences between the numbers of the prevalence-based APE teachers needed and the numbers of market-based APE teachers needed ( $S - N$ ). Those data revealed in the ninth column are the differences between the percentages of the prevalence-based APE teachers shorted and the percentages of market-based APE teachers shorted ( $Pp - Pm$ ). The summarized data at the national level are presented in the last row of Columns 8 and 9.

### Discussion

The results presented in Table 1 provide quantitative answers to three research purposes proposed in this study. First, the market-based need for additional APE teachers does exist in the public schools across the nation based on specific data reported to USDE by each state (the latest data available taken from the *27th Annual Report*; USDE, 2007). As presented in Table 1, a total of 6996 APE

**Table 1**

*The Data Used and Results Found from the Conduction of the Market-based Calculation Model and the Prevalence-based Projection Model*

State	Market-based			Prevalence-based			Difference	
	T	N	Pm	S/R	S/R - F	Pp	S - N	Pp - Pm
Alabama	107	4	3.74	455	352	77.37	348	73.64
Alaska	13	0	.00	79	66	83.49	66	83.49
Arizona	251	35	13.94	600	384	63.98	349	50.03
Arkansas	3	0	.00	280	277	98.93	277	98.93
California	1002	86	8.58	3803	2886	75.89	2800	67.31
Colorado	42	5	11.90	S	427	92.02	422	80.11
Connecticut	0	0	--	342	--	--	--	--
Delaware	0	0	--	81	--	--	--	--
DC	0	0	--	44	--	--	--	--
Florida	193	10	5.18	1593	1410	88.51	1400	83.33
Georgia	54	3	5.56	917	866	94.44	863	88.88
Hawaii	2	0	.00	122	120	98.36	120	98.36
Idaho	3	0	.00	154	151	98.06	151	98.06
Illinois	229	2	.87	1309	1082	82.65	1080	81.78
Indiana	25	0	.00	654	629	96.18	629	96.18
Iowa	15	0	.00	293	278	94.88	278	94.88
Kansas	53	2	3.77	288	236	81.97	234	78.19
Kentucky	46	1	2.17	408	363	88.97	362	86.80
Louisiana	375	24	6.40	487	136	27.90	112	21.50
Maine	13	1	7.69	123	111	90.26	110	82.57
Maryland	166	16	9.64	560	410	73.22	394	63.58
Massachusetts	128	12	9.38	605	488	80.66	476	71.28
Michigan	63	5	7.94	1048	990	94.46	985	86.53
Minnesota	363	11	3.03	522	170	32.51	159	29.48
Mississippi	747	112	14.99	313	-321	-102.79	-433	-117.79
Missouri	23	0	.00	582	559	96.05	559	96.05
Montana	3	0	.00	93	90	96.77	90	96.77
Nebraska	0	0	--	183	--	--	--	--
Nevada	68	2	2.94	229	163	71.16	161	68.22
New H.	50	3	6.00	128	81	63.25	78	57.25
New Jersey	332	16	4.82	855	539	63.04	523	58.22
New Mexico	0	0	--	208	--	--	--	.
New York	1388	255	18.37	1853	720	38.86	465	20.49
North Carolina	55	8	14.55	837	791	94.51	783	79.96
North Dakota	7	0	.00	64	57	89.09	57	89.09
Ohio	155	6	3.87	1158	1009	87.14	1003	83.27
Oklahoma	14	0	.00	364	350	96.16	350	96.16
Oregon	59	1	1.69	352	294	83.50	293	81.81
Pennsylvania	165	2	1.21	1185	1022	86.25	1020	85.04
Rhoda Island	235	0	.00	102	-133	-129.27	-133	-129.27
South Carolina	32	0	.00	420	388	92.38	388	92.38
South Dakota	10	5	50.00	82	77	93.93	72	43.93
Tennessee	17	0	.00	569	552	97.01	552	97.01
Texas	0	0	--	2487	--	--	--	--
Utah	18	0	.00	297	279	93.95	279	93.95
Vermont	6	0	.00	60	54	89.98	54	89.98
Virginia	261	6	2.30	738	483	65.46	477	63.16
Washington	33	2	6.06	625	593	94.88	591	88.82

Table 1 (cont.)

State	Market-based			Prevalence-based			Difference	
	T	N	Pm	S/R	S/R - F	Pp	S - N	Pp - Pm
West Virginia	14	0	.00	164	150	91.47	150	91.47
Wisconsin	140	2	1.43	560	422	75.34	420	73.91
Wyoming	18	3	16.67	52	37	71.25	34	54.58
National Level	6996	640	9.15	26445	20087	75.96	19452	66.81

Keys: *T* = Total APE teachers employed; *N* = Not fully certified APE teachers hired; *Pm* = Percent of the shortage of APE teachers based on the number of positions funded; *S/R* = Total APE teachers estimated based on students requiring APE services; *S/R - F* = APE teachers shorted based on students requiring APE services; *Pp* = Percent of the shortage of APE teachers based on the number of students with disabilities needing APE services; *S - N* = number difference between the prevalence-based need and the market-based need for additional APE teachers; and *Pp - Pm* = percent difference between the prevalence-based need and the market-based need for additional APE teachers

teachers were employed (i.e., APE teacher position funded) by a total of 45 states (excluding Connecticut, Delaware, Nebraska, New Mexico, Texas, and District of Columbia for which no data were reported to the USDE). Among the employed APE teachers, however, a total of 640 APE teachers hired were not fully certified. These data resulted in 9.15% of the shortage of fully certified APE teachers in the total APE teachers employed in the APE job market in the public schools (i.e.,  $[640 / 6996] \times 100 = 9.15\%$ ). For each of the 100 APE teachers hired in the public schools, in other words, about 9 APE teachers were not certified to deliver APE services to their students with disabilities. Based on the APE positions funded, therefore, a shortage of fully certified APE teachers does currently exist in the public schools. This finding is consistent with the results found by Zhang and Chen (2004) where a yearly mean of the 403 APE teachers shorted has been documented from 1984-85 to 1995-96 using the data from the *9th to 21st Annual Reports* to the USDE.

Second, the prevalence-based need for additional APE teachers is significant in the pub-

lic schools across the nation based on the data taken from the *27th Annual Report* (USDE, 2007) and the national survey completed by Kelly and Gansneder (1998). Table 1 shows that 26,445 APE teachers are needed based on the number of students who require APE services; only 6,358 fully certified APE teachers, however, are reported to the USDE as the currently employed personnel. This indicates that 20,087 more qualified APE teachers are needed to ensure all APE students to receive appropriate APE services. This results in a 75.96% of the shortfall in fully certified APE teachers needed for the student population requiring APE services (i.e.,  $[20,087/26,445] \times 100 = 75.96\%$ ). In other words, the total number of the fully certified APE teachers currently employed (6,358) in APE job market represents only 24.04% ( $[6,358 / 26,445] \times 100 = 24.04\%$ ) in the total number of fully certified APE teachers estimated based on the student populations requiring APE services (26,445). This finding supports the results found by Zhang et al. (2000) where a shortfall of 79.74% of APE teachers with full certifications was documented.

Third, a significant difference can be found between the market-based need for additional APE teachers and the prevalence-based need for additional APE teachers. Table 1 reveals that at the national level, the difference between the percentage of prevalence-based need for additional APE teachers (75.96%), while the percentage of market-based need for additional APE teachers (9.15%) is 66.81% (i.e.,  $75.96\% - 9.15\% = 66.81\%$ ), showing that the shortage of qualified APE teachers based on the number of students who require APE services in the public schools is much more significant than that based on the number of the APE teacher positions funded by the states. Among each of the 100 APE teachers, in other words, about nine qualified APE teachers are needed to fill out the APE teacher job positions funded by the states and about 76 qualified APE teachers are needed to ensure all the students requiring APE services to receive appropriate APE services. It results in a significant discrepancy of 67 more APE teachers are needed based on the number of students requiring APE service than that based on the number of positions funded (i.e.,  $76 - 9 = 67$ ). This finding documents that the prevalence-based shortage of the qualified APE teachers is much more substantial than the market-based shortage of the qualified APE teachers.

The reason this finding exists has not been documented in the APE research literature yet. Logically, however, this finding would be the result of the two primary reasons. First, the budget for APE teacher positions funded in each state was too small to ensure all eligible students would receive the APE services. In Michigan, for example, only 63 APE teachers are currently hired for a student population requiring APE services of 108,965, which results in a substantial difference of the 984 APE teacher positions shorted from the 1,047 APE teacher positions estimated ( $1,047 - 63 = 984$ ). It is clear that this difference would not exist if this state had funded a total of 1,047

APE Teacher positions to serve the 108,965 students requiring APE services. Advocacy actions should therefore be taken to lobby the personnel planning committee in each state to fund more APE teacher positions.

Second, the supply of the qualified APE teachers is not big enough to meet the need of all the students requiring APE services. Based on the APE employment market (i.e., the number of APE teacher positions funded) in Michigan, for example, five out of the 63 APE teacher positions funded are filled by people who are not fully certified, resulting in a 7.94% shortage of qualified APE teachers (see Table 1). This implies that because of the limited supply of the qualified APE teachers, personnel planning committees may have a hard time to increase their budget for more APE teacher positions. How willing would a state be to fund additional personnel positions in a professional field if those qualified applicants were difficult to find in the employment market? Clearly, more APE teachers with full certifications should be trained for filling out all the APE teacher positions in the employment market and meeting the APE needs of all the qualified APE students who need APE services.

In summary, a significant shortage of qualified APE teachers exists in the public schools across the nation based on both the number of APE teacher positions funded and the number of students requiring APE services. However, the 75.96% shortage of qualified APE teachers based on the number of students requiring APE services more dramatically highlights the need for APE teachers. The qualified APE students lose out on two fronts: states provide too few funds to hire the qualified APE teachers and there are too few qualified APE teachers available to serve all the students who require APE services. Advocacy actions should be taken to lobby each state to fund more APE teacher positions.

It should be noted that although the two sources employed in this study provide the

best-known data for using the market-based and the prevalence-based models, two known limitations should be noted. First, the term *fully certified* used in this study is derived from the data source of *27th Annual Report to Congress* where fully certified teachers are defined based on different criteria by different states. These different criteria include state certifications, state requirements, and no requirements (Westat, 2005). Thus, the term *fully certified APE teachers* defined in our study is intended to include not only APE teachers who hold state certifications, but also APE teachers who have no certifications because their states have no requirements for teaching APE.

Second, the percentage of students requiring APE services and the APE student-teacher ratio reported by Kelly and Gansneder (1998) was also limited by their sampling design and by the 62% of return rate. This means that the actual percentage of students with disabilities in the United States requiring APE and the actual APE student-teacher ratio may differ from the results of Kelly and Gansneder. For example, an APE student-teacher ratio found by Nuttall, Cheatum, and Leon, (1993) was 133:1 which was slightly greater than the 104:1 ratio used in this study, while an APE student-teacher ratio reported by Obrusnikova and Kelly (2007) was 51:1 which was about half of the ratio of 104:1. Since the results of Kelly and Gansneder represent the only known national estimates for the percentage of students with disabilities requiring APE services and the APE student-teacher ratio, the ratio reported in their study was employed in this study. Future researchers are encouraged to validate these estimates.

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