The Physical Educator Vol. 78 • pp. 242–260 • 2021
https://doi.org/10.18666/TPE-2021-V78-I3-10592

FACILITY PLANNING AND DESIGN

Strength and Conditioning Facilities in Texas High Schools: A Quantitative Analysis

J. Patrick Marsh, Jeffrey C. Petersen, Lawrence W. Judge

Abstract

The health and athletic performance benefits of strength training for adolescents have increased the demand for the development and use of strength and conditioning facilities (SCFs) within the high school setting. Despite the growing prevalence of these facilities, research on high school SCFs is limited. Therefore, the purpose of this study was to investigate the space, equipment, usage, and staffing patterns of SCFs in the state of Texas. This examination provided descriptive data on SCFs' space, equipment, usage, and staffing patterns based upon the state athletic governing body's six-tier classification level. Significant differences in SCFs' size and available equipment were determined; as well, facility usage for athletics (99.2%), physical education (24.5%), and community (30.6%) was determined. These results are indicative of the need for additional research on high school SCFs for the establishment of better school standards and best practices.

The benefits of strength training for adolescents on both athletic performance (Harries et al., 2012) and general health (Smith et al., 2014) have been well documented. As such, the demand for strength and conditioning facilities (SCFs) as part of a high school campus has increased. SCFs are now considered an integral part of a high

J. Patrick Marsh, Department of Kinesiology, Samford University. Jeffrey C. Petersen, Department of Educational Leadership, Baylor University. Lawrence W. Judge, School of Kinesiology, Ball State University. Please send author correspondence to jmarsh4@samford.edu

school for their use in physical education, athletics, and community outreach (Duehring & Ebben, 2010). Despite the documented importance of strength training on the high school population and the prevalence of SCFs as part of a high school's built environment, there has been very little research on high school SCFs. Initial examinations of all high school indoor physical activity spaces for physical education and athletics, including SCFs as a component, were conducted by Petersen (1997) in New Mexico and Indiana (Petersen, 2007, 2013). Specific examination of interscholastic SCFs was conducted by Petersen and Judge (2008) within Indiana high schools. The methodologies of these initial studies were based upon pioneering research of physical education and SCFs in the collegiate setting (Sapora & Kenney, 1961; Strand, 1988; Walker, 1989). The early studies of high school SCFs highlighted the need for descriptive, quantitative research of SCFs throughout the country (Petersen & Judge, 2008). An initial study sampling high school strength and conditioning coaches across the nation also included a brief facility component focused upon facility size in combination with school and athlete populations (Duehring & Ebben, 2010). Therefore, this study sought to address this need by examining the SCFs within Texas high schools.

The state of Texas provides an outstanding opportunity to expand the study of high school SCFs for a number of reasons. First, the most recent reporting of the National Federation of State High School Associations (NFHS, 2019) has indicated that Texas has the greatest number of total participants in interscholastic athletics with 825,925 participants in the 2018–2019 school year. The state also has the highest level of football participation both in the number of schools and in the total participants including 1,317 high schools with 165,641 athletes in 11-player football and an additional 197 schools with 3,647 athletes in 6-player football (NFHS, 2019). The large number of high schools in Texas, combined with the great breadth of school enrollment size and high levels of sport participation in general and football in particular participation, contributes to a setting where strength training would be emphasized. Therefore, the purpose of this study was to investigate the space, equipment, usage, and staffing patterns of SCFs in the state of Texas.

Three research questions guided this study of Texas high school SFCs:

- RQ1: How does school size or classification affect the prevalence and size of SCFs?
- RQ2: How does school classification affect the types of equipment found in the SCFs?
- RQ3: How does school classification affect the usage and staffing of the SCFs?

Method

Experimental Design

This investigation used a descriptive survey study design. The use of an online survey instrument allowed for the collection of data from the population sample of Texas high school athletic directors. The survey provided insight into the the space, equipment, usage, and staffing patterns of SCFs in a large state in the Southwestern United States. These data allow for a better understanding of these important facilities for the establishment of better school standards and best practices.

Procedures

A 72-item survey instrument was developed for the collection of data on the SCFs in high schools throughout the state of Texas. This instrument was developed through the modification of the instrument used by Petersen and Judge (2008) to collect data on SCFs in Indiana high schools. All modifications made to the original instrument were clerical changes, necessary to address differences in demographics and terminology between the two states. The survey instrument was formatted for distribution through the Qualtrics online survey platform. A recruitment email containing information about the study and a link to the survey was sent to the athletic director of every high school in the state of Texas. The athletic directors were directed to either complete the survey themselves or to forward the survey to their strength and conditioning coach for completion. Before completing the survey, the subjects were informed of the purpose and the associated risks and benefits of the investigation. Participants meeting all inclusion criteria gave their informed consent in accordance with the Declaration of Helsinki. For an im-

provement in response rates, follow-up emails were sent 3 weeks and 6 weeks following the initial contact. The survey instrument and research protocols were approved by the university Institutional Review Board.

Statistical Analyses

SPSS 24.0 was used for all descriptive, chi-square, and ANOVA statistical analyses with a significance level established at .05 for all analyses. All post hoc pairwise analyses were Bonferroni corrected from multiple comparisons when more than two groups were compared.

Results

This study provides important baseline descriptive data for practitioners in sport that can be used to improve SCFs and enhance the delivery of strength and conditioning services to athletes and physical education students in the high school setting. A total of 1,499 public and private high schools were identified in the state of Texas. Of these schools, 1,451 had valid email addresses listed for the athletic director. Sixty-nine nonduplicated email addresses were nondeliverable. From this pool of 1,382 schools contacted for this study, 245 surveys were completed, for a response rate of 17.7%. These schools included public institutions governed by the University Interscholastic League (UIL) as the statewide association for interscholastic athletics as well as private high schools with membership in either the Texas Association of Private and Parochial Schools (TAPPS) or the Texas Christian Athletic League (T-CAL). The respondents were balanced among the six UIL enrollment classifications and the private school category as 8.6% 1A, 12.7% 2A, 13.1% 3A, 16.7% 4A, 14.7% 5A, and 18.4% 6A, and 15.9% were private schools.

Facility Size

A total of 229 (93.5%) schools indicated the presence of a dedicated SCF within their school's physical plant. These dedicated facilities ranged in size from 200 sq ft to 30,000 sq ft with an overall mean of 3,461 sq ft (SD ± 3,779). Table 1 shows a comparison of the mean square footage of the SCFs by school classification. An ANOVA revealed a significant difference in facility size among the seven classifications, $F(6, 228) = 8.313$, $p < .001$. Tukey post hoc testing revealed

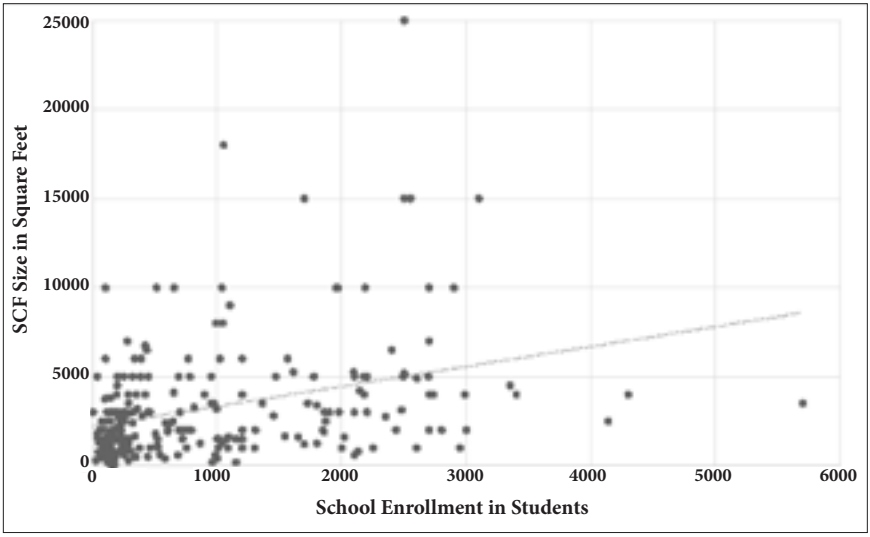
Table 1
Mean Strength and Conditioning Facility Size in Square Feet by Classification

1A $n = 21$	2A $n = 31$	3A $n = 32$	4A $n = 41$	5A $n = 36$	6A $n = 45$	Private $n = 39$	Combined $N = 245$
1416	2766	2615	3548	3814	6359	1775	3461

that the UIL 6A schools had SCFs that were significantly larger than each of the other classifications; however, no other differences between classification levels were statistically significant.

In addition to the comparison of mean facility size for enrollment classification, the relationship between school enrollment and the size of the SCF was assessed via a Pearson correlation coefficient analysis. There was a significant positive correlation ($r = .337$, $p < .001$) between these two variables, indicating the linear relationship between the school's student enrollment and the size of the SCF measured in square footage, and Figure 1 illustrates this relationship including the data points along with a line of best fit.

Figure 1
Scatterplot of School Enrollment and Strength and Conditioning Facility Size



An analysis of the space allocation within the SCFs for free weights, weight machines, and cardio equipment revealed mean percentages of 81.5% of the facility allocated to free weights, 13.0% allocated to weight machines, and 2.9% allocated to cardio equipment. The only significant difference found among the school classifications was in the space allocated to free weights, $F(6, 238) = 5.048$, $p < .001$. A Tukey post hoc analysis revealed that private schools allocated significantly less space to free weights than every UIL classification except for 2A schools.

Free Weights

Two hundred forty-two of the 245 schools indicated the presence and use of free weights within their SCF (98.8%). The key elements of free weight use analyzed in this study were the use of bench press, squat, and power clean stations as well as the use of dumbbells. Table 2 shows a comparison of the mean availability of each of these elements by school classification. The mean values for number of each station, the high and low weight ranges of the dumbbells, and the total number of Olympic bars were compared via ANOVA. Significant differences were found among the classifications in the number of bench press stations, $F(6, 238) = 16.781$, $p < .001$; squat stations, $F(6, 238) = 7.986$, $p < .001$; power clean stations, $F(6, 238) = 18.225$, $p < .001$; Olympic bars, $F(6, 238) = 20.025$, $p < .001$; and high range, $F(6, 238) = 7.510$, $p < .001$, and low range, $F(6, 238) = 2.467$, $p = .025$, of dumbbell weights. Tukey post hoc tests revealed several significant differences among classifications, summarized in Table 2. The most notable differences include 6A schools having more power clean stations than did every other classification and more bench press stations and Olympic bars than did every other classification, except 5A. It is also notable that 1A and private classifications had significantly fewer of each free weight station type than 5A and 6A schools.

Table 2
Free Weight Equipment Mean Comparisons

Equipment	1A *n* = 21	2A *n* = 31	3A *n* = 32	4A *n* = 41	5A *n* = 36	6A *n* = 45	Private *n* = 39	Combined *N* = 245
Bench press stations	4.0 $_{4,5,6}$	8.0 $_{5,6}$	7.9 $_{5,6}$	10.0 $_{1,6,7}$	12.2 $_{1,2,3,7}$	15.1 $_{1,2,3,4,7}$	5.4 $_{4,5,6}$	9.5
Squat stations	3.8 $_{2,5,6}$	11.1 $_{1}$	7.9 $_{6}$	10.4	13.1 $_{1,7}$	15.3 $_{1,3,7}$	5.2 $_{5,6}$	10.1
Power clean stations	3.1 $_{4,5,6}$	7.7 $_{6}$	7.6 $_{6}$	9.3 $_{1,6,7}$	11.3 $_{1,6,7}$	15.2 $_{1,2,3,4,5,7}$	4.8 $_{4,5,6}$	9.0
Olympic bars	9.1 $_{3,4,5,6}$	18.4 $_{5,6}$	18.6 $_{1,5,6}$	21.7 $_{1,6,7}$	28.1 $_{1,2,3,7}$	33.2 $_{1,2,3,4,7}$	12.0 $_{4,5,6}$	21.3
Dumbbell sets	2.5	2.4	3.3	3.7	2.2	2.4	1.9	2.6
Dumbbell low weight	6.9	8.5	6.7	9.0 $_{7}$	8.9	8.0	5.5 $_{4}$	7.7
Dumbbell high weight	60.0 $_{2,3,4,5,6}$	92.3 $_{1}$	85.6 $_{1,4}$	107.0 $_{1,3,7}$	91.8 $_{1}$	92.1 $_{1}$	77.3 $_{4}$	88.6

[1] Significantly different from 1A schools, $p < .05$
[2] Significantly different from 2A schools, $p < .05$
[3] Significantly different from 3A schools, $p < .05$
[4] Significantly different from 4A schools, $p < .05$
[5] Significantly different from 5A schools, $p < .05$
[6] Significantly different from 6A schools, $p < .05$
[7] Significantly different from private schools, $p < .05$

Selectorized Weight Machines

Of the 245 schools from which data were collected, 81 (33.1%) reported the use of selectorized, or pin select, weight machines in their SCFs. Broken down by classification, 4.8% of 1A schools, 25.8% of 2A schools, 25.0% of 3A schools, 19.5% of 4A schools, 36.1% of 5A schools, 46.7% of 6A schools, and 56.4% of private schools used selectorized weight machines. An ANOVA found these differences to be significant, $F(6, 238) = 4.750$, $p < .001$, and a Tukey post hoc analysis revealed significant differences between 1A schools and both 6A and private schools as well as between 4A schools and private schools. Lat pull down (26.9%), leg curl (20.4%), leg extension (19.2%), tricep extension (18.4%), and cable row (16.3%) were the selectorized machines found most frequently within the SCFs. Significant differences were found among classifications for the prevalence of lat pull down, $F(6, 238) = 4.351$, $p < .001$; tricep extension, $F(6, 238) = 3.837$, $p = .001$; and seated military press machines, $F(6, 238) = 2.395$, $p = .029$. Table 3 shows a complete summary of selectorized equipment allocations.

Plate-Loaded Machines

Plate-loaded weight equipment, commonly associated with the Hammer Strength brand name, was found in 146 out of 245 (59.6%) schools from which data were collected. Plate-loaded equipment was present in 57.1% of 1A schools, 58.1% of 2A schools, 53.1% of 3A schools, 61.0% of 4A schools, 58.3% of 5A schools, 75.6% of 6A schools, and 48.7% of private schools. ANOVA analyses revealed no significant differences among classifications in the presence of plate-loaded equipment nor for the presence of any specific piece of plate-loaded equipment. Leg press (36.7%), leg extension (35.5%), leg curl (34.7%), and lat pull down machines (29.4%) were the most common pieces of plate-loaded equipment found in these high school SCFs. Table 4 shows a comprehensive breakdown of the plate-loaded equipment in these SCFs.

Table 3
Selectorized Weight Machine Prevalence

Weight machine	1A *n* = 21	2A *n* = 31	3A *n* = 32	4A *n* = 41	5A *n* = 36	6A *n* = 45	Private *n* = 39	Combined *N* = 245
Lat pull down	4.8% [7]	12.9% [7]	15.6% [7]	19.5% [7]	36.1%	35.6%	48.7% [1,2,3,4]	26.9%
Cable row	4.8%	6.5%	15.6%	9.8%	22.2%	22.2%	25.6%	16.3%
Low row	4.8%	3.2%	9.4%	9.8%	13.9%	15.6%	20.5%	11.8%
Pec dec	0%	6.5%	6.3%	7.3%	5.6%	13.3%	5.1%	6.9%
Tricep extension	4.8% [7]	6.5% [7]	12.5%	7.3% [7]	30.6%	22.2%	35.9% [1,2,4]	18.4%
Leg extension	0%	9.7%	18.8%	19.5%	25.0%	22.2%	28.2%	19.2%
Leg curl	0%	12.9%	18.8%	19.5%	27.8%	24.4%	28.2%	20.4%
Leg press	0%	9.7%	12.5%	9.8%	22.2%	20.0%	28.2%	15.9%
Adductor	4.8%	3.2%	3.1%	0%	2.8%	4.4%	7.7%	3.7%
Abductor	4.8%	6.5%	0%	0%	2.8%	4.4%	7.7%	3.7%
4-Way hip	0%	3.2%	0%	2.4%	2.8%	4.4%	7.7%	3.3%
Seated calf	0%	0%	6.3%	0%	2.8%	4.4%	10.3%	3.7%
Standing calf	4.8%	3.2%	6.3%	4.9%	2.8%	4.4%	12.8%	5.7%
Military press	0%	6.5%	0% [7]	9.8%	5.6%	6.7%	20.5% [3]	7.8%
Lateral raise	0%	0%	3.1%	4.9%	5.6%	2.2%	10.3%	4.1%
Abdominal crunch	4.8%	6.5%	3.1%	2.4%	11.1%	13.3%	15.4%	8.6%
Back hyperextension	0%	3.2%	9.4%	9.8%	8.3%	22.2%	10.3%	10.2%
Rotary torso	0%	0%	3.1%	2.4%	0%	2.2%	2.6%	1.6%

[1] Significantly different from 1A schools, $p < .05$
[2] Significantly different from 2A schools, $p < .05$
[3] Significantly different from 3A schools, $p < .05$
[4] Significantly different from 4A schools, $p < .05$
[5] Significantly different from 5A schools, $p < .05$
[6] Significantly different from 6A schools, $p < .05$
[7] Significantly different from private schools, $p < .05$

Table 4
Plate-Loaded Weight Machine Prevalence

Plate-loaded weight machine	1A *n* = 21	2A *n* = 31	3A *n* = 32	4A *n* = 41	5A *n* = 36	6A *n* = 45	Private *n* = 39	Combined *N* = 245
Flat bench	9.5%	9.7%	12.5%	17.1%	13.9%	17.8%	12.8%	13.9%
Close grip bench	4.8%	3.2%	6.3%	9.8%	5.6%	6.7%	0%	5.3%
Incline bench	14.3%	12.9%	12.5%	14.6%	16.7%	24.4%	15.4%	16.3%
Military press	4.8%	6.5%	9.4%	9.8%	13.9%	17.8%	12.8%	11.4%
Lat pull down	38.1%	35.5%	31.3%	26.8%	44.4%	26.7%	10.3%	29.4%
Low row	19.0%	12.9%	9.4%	9.8%	22.2%	13.3%	5.1%	12.7%
T-bar row	9.5%	9.7%	6.3%	12.2%	13.9%	6.7%	2.6%	8.6%
4-way neck	4.8%	22.6%	6.3%	14.6%	25.0%	22.2%	12.8%	16.3%
Shoulder shrug	4.8%	3.2%	3.1%	9.8%	5.6%	6.7%	7.7%	6.1%
Leg extension	47.6%	41.9%	37.5%	29.3%	41.7%	40.0%	17.9%	35.5%
Leg curl	42.9%	41.9%	37.5%	24.4%	41.7%	44.4%	15.4%	34.7%
Leg press	28.6%	41.9%	40.6%	36.6%	27.8%	44.4%	33.3%	36.7%
Squat	28.6%	9.7%	15.6%	17.1%	22.2%	17.8%	10.3%	16.7%
Seated calf	9.5%	3.2%	6.3%	4.9%	11.1%	4.4%	5.1%	6.1%
Standing calf	0%	0%	9.4%	4.9%	8.3%	4.4%	7.7%	5.3%
Bicep curl	4.8%	0%	9.4%	7.3%	11.1%	6.7%	2.6%	6.1%
Tricep extension	14.3%	0%	9.4%	4.9%	16.7%	15.6%	5.1%	9.4%

Cardio Equipment

Cardiovascular exercise equipment was present in 89 of 245 (36.3%) SCFs. This was broken down by classification as 14.3% of 1A schools, 29.0% of 2A schools, 31.3% of 3A schools, 36.6% of 4A schools, 41.7% of 5A schools, 42.2% of 6A schools, and 46.2% of private schools using cardio equipment in their SCFs. ANOVA analyses revealed no significant differences among classifications in the presence of cardio equipment nor for the presence of any specific piece of cardio equipment. Exercise bikes (standard, recumbent, or spin; 32.2%), treadmills (21.2%), and elliptical machines (20.8%) were the most prevalent pieces of cardio equipment in SCFs. Table 5 contains a complete summary of the cardio equipment available in the SCFs.

Facility Use

In addition to the space and equipment allocations in SCFs, this study also examined different uses of these facilities. Nearly all of the SCFs (99.2%) were used by athletic teams, with the most prevalent use coming from football (98.4%), boys' track and field (92.2%), boys' basketball (88.6%), and baseball (82.9%). Table 6 provides a summary of usage by team and gender for each enrollment category as well as for the sport team as a whole. Just below half (44.9%) of the SCFs were operated coeducationally, while 55.1% of these facilities had males and females train separately. Weight training classes for physical education credit were offered in 24.5% of the SCFs during the school day, and 13.1% of these SCFs were utilized for student-athletes weight training sessions before or after school hours. SCFs were available for use by community members at 30.6% of the schools, and of these facilities open for community use, 2.8% charged a fee for access and use for the community members.

Facility Staffing

The final aspect of the high school SCFs examined in this study was the staffing patterns for the facilities. A dedicated strength and conditioning coach was employed at 37.1% of the schools in this study, and 94.5% of these coaches were employed by the school in a full-time position. There was no significant difference among classifications in the prevalence of a dedicated strength and conditioning coach. ANOVA analyses comparing the full- and part-time staffing

Table 5
Cardio Equipment Prevalence

Cardio equipment	1A *n* = 21	2A *n* = 31	3A *n* = 32	4A *n* = 41	5A *n* = 36	6A *n* = 45	Private *n* = 39	Combined *N* = 245
Treadmills	0%	12.9%	15.6%	26.8%	19.4%	31.1%	28.2%	21.2%
Stair stepper	0%	3.2%	0%	4.9%	8.3%	8.9%	7.7%	5.3%
Elliptical	4.8%	19.4%	15.6%	22.0%	27.8%	22.2%	25.6%	20.8%
Bike	14.3%	29.0%	25.0%	29.3%	33.3%	42.2%	41.0%	32.2%
Norditrack	0%	0%	3.1%	0%	2.8%	0%	0%	0.8%

Table 6
Sport Team Usage of Strength and Conditioning Facility by Percentage

Team	1A *n* = 21	2A *n* = 31	3A *n* = 32	4A *n* = 41	5A *n* = 36	6A *n* = 45	Private *n* = 39	Combined *N* = 245
Baseball	42.9%	83.4%	96.9%	100%	88.9%	88.9%	61.5%	82.9%
Basketball (boys)	95.2%	90.3%	100%	95.1%	80.6%	84.4%	79.5%	88.6%
Basketball (girls)	81.0%	83.9%	96.9%	80.5%	80.6%	73.3%	41.0%	80.0%
Cheerleading	9.5%	19.4%	6.7%	17.1%	8.3%	11.1%	15.4%	12.7%
Cross country (boys)	61.9%	58.1%	62.5%	46.3%	50.0%	53.3%	33.3%	51.0%
Cross country (girls)	57.1%	67.7%	62.5%	46.3%	47.2%	87.5%	25.6%	49.0%
Football	100%	96.8%	100%	100%	100%	100%	92.3%	98.4%
Golf (boys)	61.9%	38.7%	46.9%	24.4%	13.9%	20.0%	15.4%	26.5%
Golf (girls)	38.1%	35.5%	46.9%	22.0%	16.7%	17.8%	10.3%	24.9%
Softball	9.5%	67.7%	90.6%	75.6%	83.3%	77.8%	35.9%	66.1%
Swim & dive (boys)	0.0%	0.0%	0.0%	4.9%	16.7%	28.9%	2.6%	9.0%
Swim & dive (girls)	0.0%	0.0%	0.0%	4.9%	16.7%	26.7%	5.1%	9.0%
Tennis (boys)	42.9%	19.4%	37.5%	43.9%	27.8%	26.7%	5.1%	28.2%
Tennis (girls)	38.1%	19.4%	37.5%	43.9%	25.0%	24.4%	5.1%	26.9%
Track & field (boys)	100%	100%	93.4%	95.1%	83.3%	88.9%	89.7%	92.2%
Track & field (girls)	95.2%	80.6%	87.5%	75.6%	69.4%	82.2%	82.1%	80.8%
Volleyball (girls)	38.1%	51.6%	87.5%	78.0%	75.0%	82.2%	71.8%	71.8%
Wrestling (boys)	0.0%	3.2%	3.1%	12.2%	27.8%	60.0%	12.8%	20.0%
Wrestling (girls)	0.0%	0.0%	0.0%	4.9%	16.7%	28.9%	2.6%	9.0%

patterns for the school year and the summer revealed only one significant difference. The 5A schools used significantly higher numbers of full-time staff members during the summer than 1A schools, $F(6, 238) = 2.530$, $p = .022$. Table 7 shows a complete summary of the staffing patterns by classification.

Discussion

The results of this study demonstrate from RQ1 that there are both significant differences of SCF size based upon school enrollment categories as well as a significant positive correlation between school enrollment and SCF size. The results of this study show several notable differences and several similarities from the prior study of Indiana high school SCFs (Petersen & Judge, 2008). The SCFs in Texas were on average about 600 sq ft larger than those in Indiana; however, as in Indiana, in Texas the largest classification of schools had significantly larger SCFs than any other classification. This relationship between enrollment and space also aligns with findings of studies examining collegiate SCFs (Sapora & Kenney, 1961; Strand, 1988; Walker, 1989). With the trend of a positive relationship between enrollment and SCF size being well established in the literature, future research should begin to quantify this relationship. This would allow for evidence-based recommendations for the appropriate space needed for an SCF based upon either current school enrollment or anticipated school enrollment to be used within the facility planning processes.

The types and amounts of equipment within SCFs were assessed within RQ2 of this study, and numerous differences were identified by school classification in relation to the equipment for free weight training as well as for the use of selectorized equipment and cardio equipment. While the number of significant differences in equipment by enrollment classification was most prominent for free weight equipment, this finding may be in relation to the greater emphasis on training with free weights within this state. One of the notable differences between the SCFs of Texas and the SCFs of Indiana is in the equipment selection. While the availability of free weights was extremely common in both studies, 99.1% in Indiana and 98.8% in Texas, the availability of selectorized weight machines (90.7% Indiana to 33.1% Texas), plate-loaded machines (75.9% Indiana to 59.6% Texas), and cardio equipment (64.8% Indiana to 36.3% Texas)

Table 7
Strength and Conditioning Facility Staffing Patterns

Staffing	1A *n* = 21	2A *n* = 31	3A *n* = 32	4A *n* = 41	5A *n* = 36	6A *n* = 45	Private *n* = 39	Combined *N* = 245
Dedicated strength coach	33.3%	32.3%	34.4%	39.0%	38.9%	37.8%	41.0%	37.1%
Strength coach full-time employee	100%	100%	100%	100%	100%	100%	68.8%	94.5%
Strength coach other coaching duties	100%	100%	90.9%	93.8%	85.7%	88.2%	75.0%	89.0%
Full-time staff school year (*m*)	1.19	3.81	5.84	3.59	5.64	4.29	1.72	3.84
Part-time staff school year (*m*)	1.00	0.10	0.41	1.41	0.44	0.58	1.69	0.83
Full-time staff summer (*m*)	0.57	2.48	1.44	3.17	4.75	2.42	1.41	2.45
Part-time staff summer (*m*)	1.10	0.65	1.47	2.24	2.22	2.53	1.49	1.77

was much higher in the Indiana study than in the Texas study. There are a couple of possible explanations for these differences. First, there has been a shift in training techniques since the Indiana study was completed in 2008. Training with free weights has a great deal of physiological benefit and perhaps strength and conditioning coaches and athletic directors are beginning to view these benefits as outweighing the safety benefits associated with weight machines. This finding highlights the need for longitudinal research on SCFs. Without tracking the data over time, it is difficult to identify trends in the industry and to determine possible underlying causes.

A second possible explanation for the differences in the equipment selection is the differences in the usage of the facilities. The Indiana study found that 90.7% of schools used their SCF for weight training classes for physical education credit, compared to just 24.5% of schools in the Texas study. This is likely due to the "athletic period" concept that is common in Texas. Many Texas high school students receive physical education credit for participation in athletics and use the SCF during an "athletic period" with their athletic team rather than in a general physical education class for credit. With such a smaller number of nonathlete students using the SCF in Texas, schools may be likely to equip their SCF with athletic performance in mind rather than physical education.

The final research question (RQ3) addressed the facility staffing and facility usage. The National Strength and Conditioning Association (NSCA) makes several staffing recommendations in their Strength and Conditioning Professional Standards and Guidelines (Waller et al., 2009). These recommendations include having a strength and conditioning practitioner with an applicable college degree to lead the program. This practitioner should develop a team to instruct and monitor the strength and conditioning program. Additionally, the NSCA recommends a professional-to-participant ratio of no greater than 1:15 for high school athletes. Despite these recommendations, only 37.1% of schools in this study reported having a dedicated strength and conditioning coach and there was only one statistically significant difference in the number of staff members employed among classifications. The presence of a dedicated strength and conditioning coach to lead the program is an apparent area of need for Texas high schools. The relatively steady

number of SCF staff across classifications is also concerning. While it is possible that these numbers are similar due to larger schools using staggered schedules for student-athletes to train, the schools with larger enrollments should seek to have larger numbers of staff supervising their SCFs to provide the appropriate levels of supervision.

Limitations

This study is not without limitations. A larger sample would have served to increase the statistical power for this research. We theorize that the limited response rate may be due to the following factors: (a) we failed to include a follow-up email reminder after the initial invitation, (b) strength coaches may not have had sufficient time to complete the survey, and (c) numerous institutions were lacking a dedicated SCF or were without full- or part-time strength and conditioning staffing. This descriptive study did not include important qualitative aspects such as dialogue with Texas high school strength and conditioning coaches about the status of SCFs or with patrons about their attitudes toward use of the facility. Giving voice to the viewpoints expressed in the survey data could have added depth to the results. The discussion of the study, therefore, was limited to issues potentially surrounding the quantitative descriptive data collected.

Conclusions and Directions for Future Research

SFCs are a common part of the built environment at the majority of Texas high schools. While nearly all high schools in the state have an SCF, only about a quarter of these schools are using these facilities for physical education and many schools are lagging behind industry standards for staffing these facilities. As such, areas for additional research specifically within Texas high schools should include

1. an analysis of strength training use in the physical education curriculum,
2. an analysis of strength and conditioning staff training and development, and
3. an analysis of funding levels and mechanisms for strength and conditioning staff.

Additional research on high school SCFs outside of Texas is also encouraged and should include

1. an expansion of descriptive, quantitative research on high school SCFs throughout the nation;
2. meta-analyses of different state studies on high school SCFs to help determine industry standards for space, equipment, and staffing; and
3. longitudinal research on high school SCFs to identify trends and track changes in the field.

References

Duehring, M. D., & Ebben, W. P. (2010). Profile of high school strength and conditioning coaches. *Journal of Strength & Conditioning Research*, *24*(2), 538–547. https://doi.org/10.1519/JSC.0b013e3181c7c772

Harries, S. K., Lubans, D. R., & Callister, R. (2012). Resistance training to improve power and sports performance in adolescent athletes: A systematic review and meta-analysis. *Journal of Science and Medicine in Sport*, *15*(6), 532–540. https://doi.org/10.1016/j.jsams.2012.02.005

National Federation of High School Associations. (2019). *2018–19 high school athletics participation survey*. https://www.nfhs.org/media/1020412/2018-19_participation_survey.pdf

Petersen, J. (1997). *Indoor activity space and ancillary space analysis in New Mexico high schools* [Unpublished doctoral dissertation]. The University of New Mexico, Albuquerque.

Petersen, J. (2007). An analysis of indoor physical education facilities in Indiana high schools. *Indiana AHPERD Journal*, *36*(2), 30–35.

Petersen, J. C. (2013). High school indoor athletic facility space planning guidelines. *Journal of Facility Planning, Design, and Management*, *1*(1), 1–15.

Petersen, J., & Judge, L. (2008). Strength and conditioning facilities analysis in Indiana high schools. *Indiana AHPERD Journal*, *37*(3), 11–16.

Sapora, A., & Kenney, H. (1961). *A study of the present status, future needs, and recommended standards regarding space used for health, physical education, physical recreation, and athletics*. Stipes Publishing.

Smith, J. J., Eather, N., Morgan, P. J., Plotnikoff, R. C., Faigenbaum, A. D., & Lubans, D. R. (2014). The health benefits of muscular fitness for children and adolescents: A systematic review and meta-analysis. *Sports Medicine*, *44*(9), 1209–1223. https://doi.org/10.1007/s40279-014-0196-4

Strand, B. (1988). *A space analysis of physical education activity areas and ancillary areas in Big Ten universities* [Unpublished doctoral dissertation]. The University of New Mexico, Albuquerque.

Walker, M. (1989). *A space analysis of physical education activity and ancillary areas in selected small colleges and universities* [Unpublished doctoral dissertation]. The University of New Mexico, Albuquerque.

Waller, M., Piper, T., & Miller, J. (2009). National Strength and Conditioning Association: Strength and conditioning professional standards and guidelines. *Strength and Conditioning Journal*, *31*(5), 14–38. https://doi.org/10.1519/SSC.0b013e3181b9c34c