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Inclusion of Tennis in Elementary and Middle School Physical Education Class Curricula

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INCLUSION OF TENNIS IN ELEMENTARY AND MIDDLE SCHOOL PHYSICAL EDUCATION CLASS CURRICULA

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A THESIS

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INCLUSION OF TENNIS IN ELEMENTARY AND MIDDLE SCHOOL PHYSICAL EDUCATION CLASS CURRICULA

ANTONIA NUGENT

PHYSICAL EDUCATION

ABSTRACT

Introduction: Childhood obesity and physical inactivity are two major health issues in the United States linked to several life threatening diseases. Because of a general lack of physical activity (PA) stemming from a sedentary lifestyle at an early age, it is critical that we provide children with a solid foundation of PA to carry into adulthood. Undoubtedly, school is the best place for instruction. Tennis is a unique sport that can be utilized to increase wellbeing in youth as it offers an abundance of health benefits as well as mental and social benefits. Research regarding tennis integration into physical education (PE) curricula is extremely limited; therefore, there is a vital need for this type of investigation.

Purpose: The overall objective of this study is to investigate if elementary and middle school PE teachers are incorporating tennis into their curricula and to explore possible barriers potentially affecting student participation**.**

Methods: A questionnaire was developed for physical educators attending a conference (n = 75). The survey consisted of categorical questions concerning the school where the respondents were employed, its inclusion of tennis in curricula and Likert 4-point scale statements towards potential barriers to tennis participation. The survey was administered at a booth located in the exhibition hall of the conference. On average, individuals completed the survey within a timeframe of 5-10 minutes.

Results: Twenty-seven percent of schools offered tennis; 73% of schools did not. Money (Odds Ratio=6.84, $p<0.05$) and courts (Odds Ratio=11.53, $p<0.01$) were the most significant perceived barriers that affected tennis inclusion in PE curricula.

Conclusion: Lack of monetary funds and tennis courts were the biggest predictors for tennis not being included in PE curricula, despite that the United States Tennis Association (USTA) provides free training and equipment for PE teachers. For children to be physically active through tennis in schools, PE teachers should be aware of the various health benefits provided by participation in tennis as well as the USTA programs that can assist with overcoming any possible barriers.

Keywords: Physical activity, elementary and middle school, physical education, tennis

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LIST OF ABBREVIATIONS

ACSM	American College of Sports Medicine
ANOVA	Analysis of variance
CDC	Centers for Disease Control and Prevention
IRB	Institutional Review Board
OR	Odds ratio
PA	Physical activity
PE	Physical Education
USTA	United States Tennis Association

INTRODUCTION

Physical inactivity is a major public health issue in the United States and is associated with increased incidence of obesity, cardiovascular disease, type 2 diabetes, cancer, depression, hypertension and anxiety (Malkogeorgos, Argiriadou, Kotzamanidou, & Marvrovouniotis, 2010). In 2008, the National Center for Health Statistics reported that only 31% of U.S. adults engaged in regular leisure-time physical activity (PA) (NCHS, 2008). In 2008, the Centers for Disease Control (CDC) reported that approximately 35% of high school students participated in at least 60 minutes of PA five or more days per week and only 30% of students reported attending daily physical education class. Researchers have demonstrated that as children age, their participation in regular PA decreases dramatically (CDC, 2008).

In July 2011, the American College of Sports Medicine (ACSM) released new minimum recommendations on the quantity and quality of exercise for adults, suggesting 150 minutes of moderate-intensity cardiorespiratory exercise during the week or 20 minutes of vigorous-intensity cardiorespiratory exercise three times per week (Kravitz, 2011). The ACSM also recommended the inclusion of neuromotor exercises that focused on increasing agility, balance and coordination (Garber et al., 2011). The CDC (2011) recommended that children and adolescents complete 60 minutes or more of PA each day, which includes aerobic and bone strengthening activities, such as tennis.

Tennis can be played as both a sport or as a recreational activity with friends and family. Tennis can be played by two people (singles) or four people (doubles) and involves different types of play, including serving the ball over the net and rallies back and forth using the forehand, backhand and volley. Explosive, full body movements, agility, balance, coordination, finesse, and strategic game planning are all components of this dynamic game (Pluim et al., 2009). Tennis also adapts to become wheelchair tennis, offering a PA both recreationally and competitively for disabled players.

Tennis requires intensities between 4.5 METs (moderate-intensity) during doubles play and 8.0 METs (vigorous-intensity) during singles play (Ainsworth et al., 2011), making tennis an ideal activity to increase both heart rate and PA level. Health benefits from playing tennis include: (i) reduced body fat (Laforest, St-Pierre, Cyr, & Gayton, 1990), (ii) increased VO_2 max (Jackson, Beard, & Wier, 1995), (iii) increased high density lipoprotein levels and endurance capacity (Pluim, Staal, Marks, Miller, & Miley, 2009) and (iv) increased daily energy expenditure (Fernandez-Fernandez et al., 2009). If tennis it is played at a sufficient frequency, intensity and duration, it fulfills the current ACSM PA recommendations for adults and CDC PA recommendations for children and adolescents. Tennis is a game that people can play throughout their lifetime and is an ideal social activity that has also been shown to provide mental health benefits (Henderson, 2006). Furthermore, previous researchers have demonstrated that tennis outperforms many other sports in the development of personality characteristics (Gavin, 2004).

QuickStart tennis is scaled down tennis, designed for children (under 10 years) (USTA, 2012). According to Proctor (2007), QuickStart tennis is less intimidating for children as it uses a smaller court, with a lower net, shorter rackets and softer and lighter balls. Incorporating QuickStart in elementary school class curricula would allow children to learn the fundamental skills of tennis, which also includes age appropriate fitness and coordination activities (USTA, 2012). Implementing tennis at an early age would introduce children to a sport that they could play throughout their lifetimes (Harrison & Narayan, 2003). The primary school PE setting is an ideal environment for children to learn the basic foundations necessary to develop healthy habits for life, including participation in daily PA (Masurier & Corbin C, 2006). However, it has been suggested that the location of a school impacts various aspects of education (Bouk, 2004). There is a lack of knowledge about the inclusion of tennis in PE curricula based on school location. This information, combined with a better understanding of the barriers to tennis play in PE classes, would support the development of strategies to overcome lack of participation in the schools. Since no questionnaire was available to assess barriers of tennis play in elementary and middle schools, a locally developed instrument was designed by the researcher. Items for the questionnaire were drafted after conducting a review of the literature related to the difficulties that physical educators often face (Crum, 1993; Curtner-Smith & Sofo, 2004; DeCorby, Halas, Wintrup, & Janzen, 2005; Placek et al., 1995; Portman, 1996). The questionnaire was refined through a series of formative research steps including: focus groups, expert review and cognitive interviews. Focus groups were used to explore the barriers faced by physical educators to teaching tennis in their curricula and to determine the specific constructs that should be included in the

questionnaire. Assistance was solicited to better understand the sources of disagreement and to re-word, discard, and/or replace items. An expert panel review was convened to assess validity and reliability of the developed items. Selected individuals were considered to be experts in the fields of exercise science and physical education. Finally, interviews were conducted with physical educators to assess the instrument with regards to comprehension and ease of use. A pilot study was performed to assess test-retest reliability. While research exists regarding the health benefits of tennis, a need existed to investigate whether or not PE teachers were utilizing tennis as a means for PA in their curriculum. The results of this research are intended to help school physical educators, tennis coaches and organizations such as the USTA gain knowledge of how to approach the introduction of tennis to schools in a more specific manner.

PURPOSE

This study aims to investigate whether elementary and middle school physical educators are incorporating tennis into their curriculum and to explore possible barriers that are potentially affecting participation. Based on a review of the literature, there have been no studies in this area; this study attempts to fill the current void.

HYPOTHESIS

It is hypothesized that school location will affect participation rates. Furthermore, urban schools will have less participation than suburban and rural schools. It is also expected that public schools will have lower participation when compared to private schools.

MATERIALS AND METHODOLOGY

Participants

Participants were physical educators of elementary and middle school students attending a state health/fitness conference in the Southeast region of the United States (n = 75). There were originally 76 participants, but one questionnaire was completed by a high school teacher and was consequently excluded from the results. The conference was chosen as a recruitment site since it attracts physical educators from a variety of school settings. The survey was administered at a booth located in the exhibition hall of the conference. On average, individuals completed the survey within a timeframe of 5-10 minutes. Approval for the study was granted by the University of Alabama at Birmingham Institutional Review Board (IRB) for research with human subjects.

A brief overview of the survey and purpose of the study was provided to all participants. The researchers were present during the completion of the questionnaire to ensure accuracy and completeness of the responses, and PE teachers were encouraged to ask questions as needed. Survey responses were anonymous since individual names and school names were not required for survey completion.

Questionnaire

The questionnaire (Appendix A) was comprised of 12 questions which were divided into 3 general sections. Part 1 included categorical questions related to the type of school setting where the respondents were employed and whether they currently

incorporated tennis as part of their curriculum. Part 2 consisted of an open-ended question regarding the number of hours of tennis education that each child received if tennis was incorporated into their curricula. Part 3 included a list of seven statements about barriers of tennis play in school PE curricula, and participants were asked to rate their agreement on a Likert 4-point scale from 'strongly disagree' to 'strongly agree'.

Statistics

Data were analyzed using SPSS statistical analysis software, version 19.0 using descriptive statistics, analysis of variance (ANOVA), independent t-test, Pearson correlations and binary logistic regression tests. One-way ANOVA was used to determine the difference in survey responses between urban, suburban and rural schools. An independent t-test was completed to assess differences in survey responses between schools that play tennis and schools that do not play tennis and perceived barriers to play (Likert scale statements), including training, enjoyment, interest, money, equipment, courts and knowledge. Means and standard deviations were analyzed to assess if some barriers were significant at $p<0.05$. Pearson correlations were performed between the Likert scale statements to determine if there was any association between barriers. Binary logistic regression was then used to identify the probability of certain Likert scale statements affecting tennis play. The dependant variable used (if the school plays or does not play tennis) has a two-way response (yes or no). The independent variables were the Likert scale statements. Odds ratios (OR) and p-values were observed to predict the likelihood of a barrier affecting participation.

RESULTS

Descriptive statistics reveal 16 elementary and 59 middle schools were represented in the study (n= 75). Twenty-eight schools were located in an urban setting, 16 suburban and 31 rural. Twenty schools played tennis during PE class and 55 did not. There were only 7 private schools represented in the study as the majority (68) were public schools. Of the 7 private schools, two included tennis in their PE curriculum (28%). Eighteen of the 68 public schools (26%) included tennis in their curriculum.

The ANOVA revealed differences in the number of hours played between school settings, with suburban schools playing an average of 7.4 hours per year. Rural schools averaged 4.9 hours and urban schools played 4.5 hours yearly. Different settings also accounted for varied participation rates of tennis, with 14.3% of urban schools, 37.5% of suburban schools and 32.3% of rural schools playing the sport in PE.

In addition, an ANOVA was conducted to determine if there was a difference in responses between school settings (urban, suburban and rural) and the Likert scale statements (Table 1). Results showed no significant differences between school settings and Likert scale statement responses ($p > 0.05$).

Using an independent t-test, responses to the Likert scale statements of the schools that played tennis (n= 20) were compared against the responses of the schools that did not play tennis (n= 55) (see Figure 1). Means for the responses provided for the following six potential barriers- (i) money, (ii) courts, (iii) equipment, (iv) training, (v) knowledge and (vi) interest were all significant factors affecting tennis participation

($p < 0.05$). Enjoyment ($p = 0.35$) was not significant.

Pearson correlations (Table 2) between the Likert scale statements revealed that lack of courts, money, equipment, training and knowledge were significantly correlated to several barriers ($p < 0.05$).

Binary logistic regression tests were also completed for the six Likert scale statements (i. money, ii. courts, iii. equipment, iv. training, v. knowledge and vi. interest) that were significant ($p < 0.05$) when the previously stated independent t-test was completed (Figure 1). Whether or not the school currently played tennis was set as the dependent variable and the six significant Likert scale statements were the independent variables (Table 3). Courts (OR=11.52 and $p<0.05$) showed the highest probability of affecting tennis play. Money had the next largest OR=4.41 showing a strong probability of affecting tennis play, and with $p=0.25$ was the closest barrier to being significant compared to the other Likert scale statements. When courts and money were tested alone through Binary Logistic Regression, the OR increased for both courts (11.53) and money (6.84), and the p value became significant (money $p=0.02$ and courts $p<0.01$) for both factors (Table 4).

DISCUSSION

Through this study, we were able to identify tennis participation rates in various school locations as well as barriers to the inclusion of tennis in PE curricula. Less tennis is played in the urban school setting (14.3% and 4.5 hours/year) as compared to both rural and suburban settings. Based on the questionnaire responses, the most PE tennis participation occured in the suburban setting (37.5% and 7.4 hours/year). Despite varied participation rates based on school setting, completing an ANOVA revealed that PE teachers from all settings (urban, suburban, and rural) identified similar potential barriers that affected tennis participation in their school (knowledge, courts, equipment, money, interest, enjoyment, training). These responses to the 4-point Likert scale statements showed no significant difference at the $p<0.05$ level, meaning that school setting has no impact regarding perceived barriers.

Of all possible tested barriers, having no courts and a lack of money were the biggest predictors for a school not incorporating tennis into their curricula. Binary logistic regression testing revealed that courts (OR=11.53) and money (OR=6.84) had the strongest likelihood of affecting tennis play. Schools were almost 12 times more likely to play tennis if they had courts and almost 7 times more likely to play tennis if they had money (Table 4). As stated previously, participants from different school settings shared a similar view regarding these two barriers. Therefore, regardless of the location, teachers viewed no tennis courts, courts being in disrepair and the lack of financial

resources to support this activity to be the major barriers affecting tennis play. Additionally, a PE teacher's enjoyment of tennis ($p= 0.35$) was the only variable not significant. This finding suggests an existing possibility for increased participation levels in tennis. If courts and money can be provided, then tennis may occur more frequently in schools.

It is important to note that Dr. Robert Pangrazy helped devise a user-friendly curriculum that aids with the inclusion of tennis in schools, even if the school has no tennis courts (USTA, 2008). In addition, the USTA offers free in-service tennis workshops to instruct PE teachers and parents to efficiently implement tennis in their school. The number of PE teachers trained by the USTA in-service workshops rose from 2,162 in 2008 to 3,486 in 2010 (USTA, 2011). The number of curricula distributed to schools rose from 721 in 2008 to 1,223 in 2010 (USTA, 2011). Despite these encouraging figures, there is limited information demonstrating that the efforts of the USTA have been effective. Because the USTA offers free in-service training, a curricula that requires no tennis courts and discounts on equipment and grants to qualifying schools, (USTA, 2008) the results from this study are surprising. The lack of reported PE participation in tennis is especially unexpected considering that curricular distribution was reported to have almost doubled since 2008 (USTA, 2011).

To reverse this trend, PE teachers need to be made aware of options like mini-tennis and free programs that the USTA offers. With all the potential benefits that tennis offers, the sport appears to be an ideal option for PE teachers to get children active and moving. In the Alabama Course of Study for Physical Education manual, tennis has been included as a sample activity for three weeks during which students are expected to

learn aspects of "consumer awareness," "exercise and aging" and "physical fitness test" through tennis (Morton, 2009). The inclusion of these topics by the Alabama Department of Education would seem to indicate that tennis is an activity well-suited to educate students on the aforementioned topics.

While beyond the scope of this investigation, a case could be made that PE teachers aware of the USTA curricula may still be unwilling to participate in tennis for reasons that have not been established in the current study, including the perception of tennis being an "individual" sport. Additionally, teachers may not want to spend time teaching technical skills used in tennis and envision that students would be sedentary for the majority of the class period until sufficient tennis skills are learned. Finally, it might also be perceived that too much time is needed to set up for tennis compared to another activity in which less equipment is used like soccer or basketball. In reality, however, tennis is an activity that extends beyond the 45-minute PE class period and can be enjoyed for a lifetime. A small amount of time invested into tennis could equate to a lifetime of healthy activity. PE teachers need to be exposed to the health, cognitive and social benefits that can be achieved solely through playing tennis. Not many other sports can provide so much in terms of physical, mental and social development. Since there is little research regarding tennis participation in elementary and middle schools, there is ample opportunity for future research to be conducted. Beyond this current study, researchers may want to consider a broader application of the survey to obtain a bigger sample, which could provide a better indication of PE tennis participation nationwide as a limiting factor of this study was its small sample size. Furthermore, the study did not include a random sample of schools since the distribution of the questionnaire was

limited to individuals who attended the state conference and opted to participate in the study. Additional questions could also be added to the questionnaire to explore other barriers to participation including the following: (i) set up time for tennis, (ii) the perception of skill development taking too long, (iii) the individual nature of the game and (iv) a view that tennis involves little movement. A longitudinal study could also demonstrate if children who receive tennis instruction at the elementary and middle school levels are more likely than their peers to continue with tennis into adulthood. Conversely, a study could also be conducted to determine if adults who are currently participating in tennis were exposed to tennis in the school setting.

CONCLUSION

For children to increase health and PA through tennis in schools, elementary and middle school PE teachers need to be made aware of the variety of benefits that tennis offers and resources available. This includes a free curricula offered by the USTA to help teachers get started with the inclusion of tennis in their schools. Money and courts should not be limiting factors, as a free curriculum is available and the sport can be improvised so that no court is needed. While beyond the scope of this investigation, there may be additional barriers that may be affecting participation in schools. It is suggested that an exploration of these other barriers may be a potential area for future studies. Further research is needed to explore the best way for tennis to appear more frequently in elementary and middle school PE curricula.

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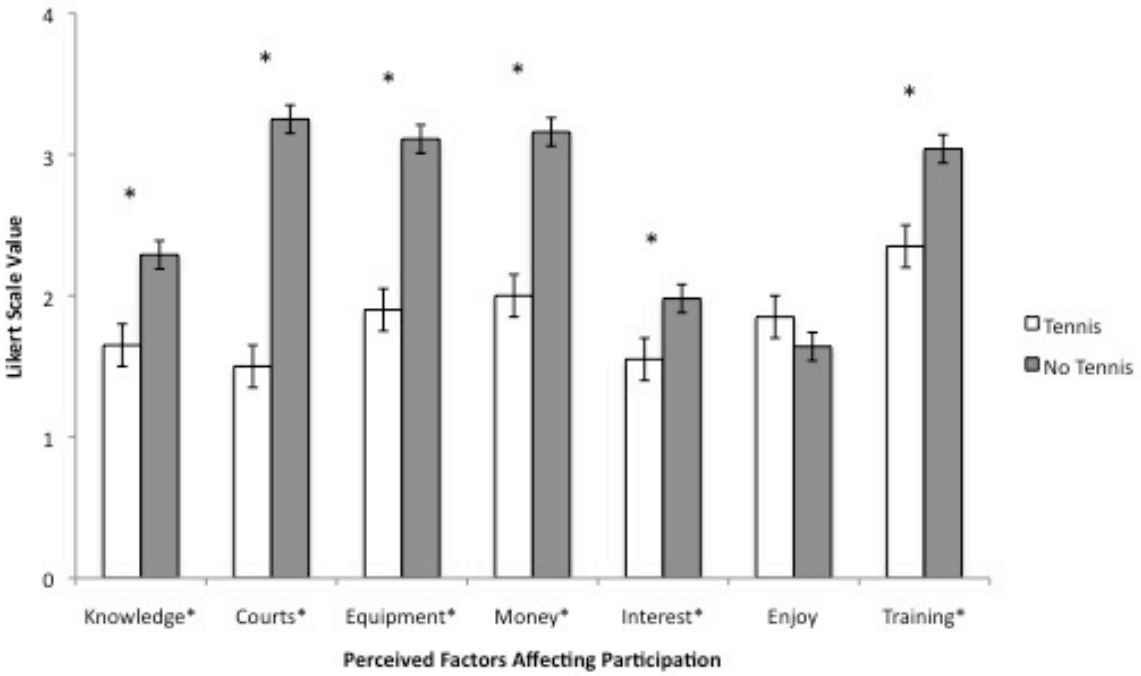
Figure 1.

Barriers to tennis play (mean ± SD)



*Significant at $p<0.05$

Values are expressed as Likert scale responses: 1=Strongly Disagree, 2=Disagree, 3=Agree, 4=Strongly Agree.
Legend: Tennis = Schools that play tennis, No Tennis = Schools that do not

Table 1.

Barriers to tennis play in urban, suburban and rural schools (mean ± SD)

	Urban	Suburban	Rural	p
Training	3.12 ± 0.57	2.56 ± 0.81	2.85 ± 1.00	0.09
Enjoy	1.68 ± 0.48	1.94 ± 1.00	1.58 ± 0.67	0.25
Interest	2.00 ± 0.77	1.56 ± 0.51	1.90 ± 0.79	0.16
Money	3.00 ± 0.77	2.94 ± 0.68	2.68 ± 0.87	0.32
Equipment	2.96 ± 0.84	2.75 ± 0.87	2.65 ± 1.08	0.43
Courts	3.14 ± 0.93	2.69 ± 1.16	2.52 ± 1.10	0.08
Knowledge	2.39 ± 0.99	2.06 ± 0.77	1.90 ±0.70	0.08

*Significant at $p < 0.05$

Values are expressed as Likert scale responses: 1=Strongly Disagree, 2=Disagree, 3=Agree, 4=Strongly Agree.

Table 2.

Pearson correlations between barriers

	Training	Enjoy	Interest	Money	Equipment	Courts	Knowledge
Training	___	-0.03	0.25*	0.37*	0.40*	0.31*	0.44*
Enjoy	-0.03	___	0.29*	-0.19	-0.14	-0.14	0.19
Interest	0.25*	0.29*	___	-0.01	0.02	0.01	0.22
Money	0.37*	-0.19	-0.01	___	0.90*	0.67*	0.25*
Equipment	0.40*	-0.14	0.02	0.90*	___	0.68*	0.35*
Courts	0.31*	-0.14	0.01	0.67*	0.68*	___	0.38*
Knowledge	0.44*	0.19	0.22	0.25*	0.35*	0.38*	___

*Significant at $p < 0.05$

Table 3.

Binary Logistical Regression analysis for significant Likert scale barriers

Barriers to Participation	Beta ± SE	Odds Ratio	p
Constant	- 10.22 ± 3.12	0.00	0.00
Training	0.42 ± 0.77	1.52	0.59
Interest	0.33 ± 0.98	1.39	0.74
Money	1.48 ± 1.28	4.41	0.25
Equipment	0.39 ± 1.29	1.48	0.76
Courts	2.44 ± 0.99	11.52	0.01*
Knowledge	-0.40 ± 0.72	0.67	0.57

*Significant at $p<0.05$

Table 4.

Binary Logistical Regression analysis of Money and Courts to predict the likelihood of tennis participation

Barriers to Participation	Beta ± SE	Odds Ratio	p
Constant	-9.50 ± 2.70	0.00	0.00
Money	1.92 ± 0.81	6.84	0.02
Courts	2.45 ± 0.74	11.53	0.00

APPENDIX A

'Tennis Survey' for Elementary and Middle School Phys. Ed. Teachers
Please select your agreement with each statement by checking the appropriate box.

I teach physical education in an Alabama:

1) Elementary School ☐ **Middle School** ☐

2) Urban setting ☐ **Suburban setting** ☐ **Rural setting** ☐

3) Private school ☐ **Public school** ☐

Do you currently incorporate the sport of tennis as part of your physical education curriculum? Yes ☐ No ☐

If yes, how many hours of tennis education does each child receive each year at your school? _____ hrs.

1. My own lack of knowledge on the sport of tennis inhibits my instruction of tennis.

☐	☐	☐	☐
Strongly Disagree	Disagree	Agree	Strongly Agree

2. We DO NOT offer tennis in PE because we have no tennis courts or our courts are in disrepair.

☐	☐	☐	☐
Strongly Disagree	Disagree	Agree	Strongly Agree

3. Lack of proper equipment (racquets, balls, nets) limits instruction of tennis.

☐	☐	☐	☐
Strongly Disagree	Disagree	Agree	Strongly Agree

4. Lack of monetary funds for tennis equipment limits instruction of tennis.

☐	☐	☐	☐
Strongly Disagree	Disagree	Agree	Strongly Agree

5. Students do not have an interest in learning tennis.

☐	☐	☐	☐
Strongly Disagree	Disagree	Agree	Strongly Agree

6. I do not enjoy the sport of tennis; therefore, I do not incorporate tennis into the curriculum.

☐	☐	☐	☐
Strongly Disagree	Disagree	Agree	Strongly Agree

7. If I were to receive training, I would be more willing to offer tennis to my classes

☐	☐	☐	☐
Strongly Disagree	Disagree	Agree	Strongly Agree

APPENDIX B

e-mailed 12/2/11

Project Revision/Amendment Form

Form version: October 28, 2010

In MS Word, click in the white boxes and type your text; double-click checkboxes to check/uncheck.

- **Federal regulations require IRB approval before implementing proposed changes. See Section 14 of the IRB Guidebook for Investigators for additional information.**
- **Change means any change, in content or form, to the protocol, consent form, or any supportive materials (such as the Investigator's Brochure, questionnaires, surveys, advertisements, etc.). See Item 4 for more examples.**

1. Today's Date	12/1/11

2. Principal Investigator (PI)

Name (with degree)	Jane Roy, PhD	**Blazer ID**	jroy
Department	Human Studies	**Division (if applicable)**	CAS
Office Address	EB 205	**Office Phone**	4-1757
E-mail	jroy@uab.edu	**Fax Number**	5-8040

Contact person who should receive copies of IRB correspondence (Optional)

Name		**E-Mail**	
Phone		**Fax Number**	
Office Address (if different from PI)			

3. UAB IRB Protocol Identification

3.a. Protocol Number	X101028012
3.b. Protocol Title	Inclusion of Tennis in Elementary and Middle School Physical Education Class Curricula

3.c. Current Status of Protocol—Check ONE box at left; provide numbers and dates where applicable

- ☐ **Study has not yet begun** — **No participants, data, or specimens have been entered.**
- ☐ **In progress, open to accrual** — **Number of participants, data, or specimens entered:**
- ☐ **Enrollment temporarily suspended by sponsor**
- ☐ **Closed to accrual, but procedures continue as defined in the protocol (therapy, intervention, follow-up visits, etc.)**
  - **Date closed:**
  - **Number of participants receiving interventions:**
  - **Number of participants in long-term follow-up only:**
- ☒ **Closed to accrual, and only data analysis continues**
  - **Date closed:** 12/1/11
  - **Total number of participants entered:** 76

4. Types of Change

Check all types of change that apply, and describe the changes in Item 5.c. or 5.d. as applicable. To help avoid delay in IRB review, please ensure that you provide the required materials and/or information for each type of change checked.

- ☐ **Protocol revision (change in the IRB-approved protocol)**
  In Item 5.c., if applicable, provide sponsor's protocol version number, amendment number, update number, etc.
- ☐ **Protocol amendment (addition to the IRB-approved protocol)**
  In Item 5.c., if applicable, provide funding application document from sponsor, as well as sponsor's protocol version number, amendment number, update number, etc.
- ☒ **Add or remove personnel**
  In Item 5.c., include name, title/degree, department/division, institutional affiliation, and role(s) in research, and address whether new personnel have any conflict of interest. See "Change in Principal Investigator" in the IRB Guidebook if the principal investigator is being changed.
  - ☒ **Add graduate student(s) or postdoctoral fellow(s) working toward thesis, dissertation, or publication**
    In Item 5.c., (a) identify these individuals by name; (b) provide the working title of the thesis, dissertation, or publication; and (c) indicate whether or not the student's analysis differs in any way from the purpose of the research described in the IRB-approved HSP (e.g., a secondary analysis of data obtained under this HSP).
- ☐ **Change in source of funding; change or add funding**
  In Item 5.c., describe the change or addition in detail, include the applicable OGCA tracking number(s), and provide a copy of the application as funded (or as submitted to the sponsor if pending). Note that some changes in funding may require a new IRB application.

☐ **Add or remove performance sites**
In Item 5.c., identity the site and location, and describe the research-related procedures performed there. If adding site(s), attach notification of permission or IRB approval to perform research there. Also include copy of subcontract, if applicable. If this protocol includes acting as the Coordinating Center for a study, attach IRB approval from any non-UAB site added.

☐ **Add or change a genetic component or storage of samples and/or data component—this could include data submissions for Genome-Wide Association Studies (GWAS)**
To assist you in revising or preparing your submission, please see the IRB Guidebook for Investigators or call the IRB office at 934-3789.

☐ **Suspend, re-open, or permanently close protocol to accrual of individuals, data, or samples (IRB approval to remain active)**
In Item 5.c., indicate the action, provide applicable dates and reasons for action; attach supporting documentation.

☐ **Report being forwarded to IRB (e.g., DSMB, sponsor or other monitor)**
In Item 5.c., include date and source of report, summarize findings, and indicate any recommendations.

☐ **Revise or amend consent, assent form(s)**
Complete Item 5.d.

☐ **Addendum (new) consent form**
Complete Item 5.d.

☐ **Add or revise recruitment materials**
Complete Item 5.d.

☐ **Other (e.g., investigator brochure)**
Indicate the type of change in the space below, and provide details in Item 5.c. or 5.d. as applicable.
Include a copy of all affected documents, with revisions highlighted as applicable.

▶

5. Description and Rationale

In Item 5.a. and 5.b, check Yes or No and see instructions for Yes responses.
In Item 5.c. and 5.d, describe—and explain the reason for—the change(s) noted in Item 4.

☐Yes ☒No **5.a. Are any of the participants enrolled as normal, healthy controls?**
If yes, describe in detail in Item 5.c. how this change will affect those participants.

☐Yes ☒No **5.b. Does the change affect subject participation, such as procedures, risks, costs, location of services, etc.?**
If yes, FAP-designated units complete a FAP submission and send to fap@uab.edu. Identify the FAP-designated unit in Item 5.c.
For more details on the UAB FAP, see www.uab.edu/cto.

5.c. Protocol Changes: In the space below, briefly describe—and explain the reason for—all change(s) to the protocol.

✓ ▶ John McCarthy, PhD, Associate Professor, School of Health Professions. His IRB training is current, and he has no conflict of interest with this project. His is a member of the student's thesis committee. All the data has been collected, and he will be participating in data analysis and writing the final paper.

✓ ▶ a) Name of student: Antonia Nugent, b) Working title of thesis: Inclusion of Tennis in Elementary and Middle School Physical Education Class Curricula, c) the student's analysis does not differ in any way from the purpose of the research described in the IRB-approved HSP

5.d. Consent and Recruitment Changes: In the space below,
(a) describe all changes to IRB-approved forms or recruitment materials and the reasons for them;
(b) describe the reasons for the addition of any materials (e.g., addendum consent, recruitment); and
(c) indicate either how and when you will reconsent enrolled participants or why reconsenting is not necessary (not applicable for recruitment materials).

Also, indicate the number of forms changed or added. For new forms, provide 1 copy. For revised documents, provide 3 copies:
- **a copy of the currently approved document (showing the IRB approval stamp, if applicable)**
- **a revised copy highlighting all proposed changes with "tracked" changes**
- **a revised copy for the IRB approval stamp.**

▶

Signature of Principal Investigator Jared Roy Date 12/1/11

FOR IRB USE ONLY

☐ Received & Noted ☑ Approved Expedited* ☐ To Convened IRB

Marilyn Dass
Signature (Chair, Vice-Chair, Designee)

12-13-11
Date

DOLA 11-22-11

Change to Expedited Category **Y / N / NA**

*No change to IRB's previous determination of approval criteria at 45 CFR 46.111 or 21 CFR 56.111

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APPENDIX C

LITERATURE REVIEW

Physical Inactivity and Health

Physical inactivity and obesity are major public health issues in the United States and in Alabama, and they are associated with cardiovascular disease, type 2 diabetes, cancer, depression, dyslipidimia, hypertension, strokes, colon and breast cancer and anxiety (Malkogeorgos, Argiriadou, Kotzamanidou, & Marvrovouniotis, 2010). In 2008, the National Center for Health Statistics reported only 31 percent of U.S. adults engage in regular leisure-time physical activity, which is defined as either three sessions per week of vigorous physical activity (causes rapid breathing and a substantial increase in heart rate) lasting 20 minutes or more, or five sessions per week of light-to-moderate physical activity (accelerates the heart rate) lasting 30 minutes or more. About 40 percent of adults report no leisure-time physical activity (PA) (National Center for Health Statistics, 2008). About 35 percent of high school students report that they participate in at least 60 minutes of physical activity on 5 or more days of the week, and only 30 percent of students report that they attend physical education class daily. As children get older, participation in regular physical activity decreases dramatically (CDC, 2008). With the influence of video games, TV and computer technology, it is becoming more difficult for children to get enough PA (CDC, 2011).

Health Benefits of Tennis

Tennis can be played by two people (called 'playing singles') or four people ('doubles') and a game of tennis involves a variety of types of play including serving the ball over the net, rallies (when the ball is hit back and forth between opponents), fast movements and strategic game play. Tennis can be played as both a sport or as a recreational activity with friends and family. While tennis is generally considered a life-long sport enjoyed by millions of recreational players world-wide and a popular spectator sport, the amount of tennis being played in the United States is on a decline (Goldman, 2011). An annual tennis participation survey, generated by the Tennis Industry Association (TIA) and United States Tennis Association (USTA), revealed alarming figures, pointing to a decrease in tennis participation in the United States (2010). The study reported on the number of frequent players (individuals who play more than 21 times per year) from 2008-2010. In 2008, there were 5.62 million frequent players; in 2009 that dropped to 5.43 million and continued a downward slide to 4.77 million frequent players in 2010 (Goldman, 2011). Additionally, total participation (those aged 6 and above who played tennis in the previous year) decreased by 8% from 30.13 million to 27.81 million from 2009-2010 (TIA & USTA, 2010).

In July 2011, the American College of Sports Medicine (ACSM) released new minimum recommendations on the quantity and quality of exercise. A notable addition was neuromotor exercise (sometimes called functional fitness training) which focuses on improving and maintaining motor skills like balance, coordination, gait, and agility

(Kravitz, 2011). Participation in the sport of tennis has been shown to improve health and fitness levels, and if played at the sufficient frequency, intensity and duration would fulfill the current ACSM PA recommendations, including the neuromotor component; as a vital part of tennis training is the development of agility, balance, dexterity, coordination and proprioception; as tennis players need to be able start and accelerate from a stationary position, make a series of movements to cover the court then decelerate to strike the ball using static or dynamic balance over the course of a match. It is also a game that people can play throughout their lifetime and is an ideal social activity that also provides mental health benefits. Furthermore, in the 2011 Compendium of Physical Activity (Ainsworth et al, 2011) types of PA are categorized through their respective metabolic equivalent of task (MET) intensity value. Tennis requires intensities between 4.5 MET (moderate-intensity) during doubles play, to 8.0 MET (vigorous-intensity) during singles play.

The health benefits of tennis play are well established. (Laforest, St-Pierre, Cyr, & Gayton, 1990) found that recreational tennis players who had played twice per week for the previous 10 years had significantly lower body fat compared to the aged-matched controls. (Pluim, Staal, Marks, Miller, & Miley, 2009) conducted a longitudinal study, in which 38 middle-aged sedentary males were assigned to one of four groups: tennis, biking, jogging or a control group. After 20 weeks of 30 minutes of the prescribed exercise type three times per week, endurance capacity of the tennis group increased by 5.7%. A study by (Jackson, Beard, & Wier, 1995) demonstrated that middle-aged tennis players had higher fitness levels, performing better in VO_2 max testing compared to a normally active control group of the same age and gender. Recreational adult tennis

players (44.8 ± 4.7 years) and advanced adult tennis players (44.3 ± 5.1 years) had no significant difference in energy expenditure during 30 minutes of play wearing a portable gas analyzer. Additionally no significant difference was seen between $V0_2$ max results during laboratory testing of the two groups. This shows that recreational adult tennis players physically benefit from tennis similarly to advanced players in regard to energy expenditure and VO_2 max (Fernandez-Fernandez et al., 2009). Thus, the level of play seems far less important to health than the actual participation in physical activity. Research has found that mean Plasma High-Density Lipoprotein (HDL or "good cholesterol") levels are profoundly higher in tennis players compared to the sedentary group (Pluim et al., 2009). In summary, people who choose to play tennis appear to have significant health benefits, including improved aerobic fitness, a lower body fat percentage, a more favorable lipid profile, a reduced risk for developing cardiovascular disease, and improved bone health.

Tennis in the Schools

Physically active children are more likely to become active adults, and participation in sports, such as tennis, can have a healthy developmental impact on children (Kjønniksen, Anderssen, & Wold, 2009). Tennis play can promote cooperative play, teamwork, and good sportsmanship while helping to refine gross motor skills (Groppel, 2012); and can also provide mental health benefits (Henderson, 2006). Physical education is huge component to public health, as this is an environment that can reach most children (Masurier & Corbin, 2006). Schools have played a central role in the provision of physical activity to American children and youth for more than a century

(Pate et al., 2006). Physical education (PE) has been an institution in American schools since the late 1800s (Wuest & Bucher, 1999) and school sports have been a growing component of the educational enterprise since the early 1900s (Pate et al, 2006). It is in a school environment where children can learn the basic foundations necessary to develop healthy habits for life, including participation in daily PA.

The regulations for PE requirements differ on a state-by-state basis. In particular, the Alabama Course of Study for Physical Education manual states: "Physical Education must be taught in all public schools in Alabama" (Morton, 2009). However, it appears that the Alabama Course of Study for Physical Education lists no specific sports to be included in the PE curriculum. Instead, the manual sets standards of development to achieve at each academic grade in 4 different areas: 1) skill development, 2) cognitive development, 3) social development and 4) physical activity. The standard of performance is expected to advance with each increase in academic grade. Sport is introduced and included from fourth grade to twelfth grade. K-3 does not integrate specific sports into PE but instead focuses more towards activities that develop "fundamental motor skills integrated with a variety of movement concepts." (Morton, 2009). The Alabama Board of Education requires PE class to be taught by teachers who are certified in P.E. Thus, the lack of guidelines regarding what to specifically include in PE class is left to the discretion of the PE instructor as long as the activities lead to the acquisition of the desired skills set forth by the Alabama Course of Study for Physical Education. An example of a PE syllabus for grades 9-12 is provided in the Alabama Course of Study for Physical Education. Tennis has been included for 3 weeks where students are expected to learn aspects of "consumer awareness," "exercise and aging" and

"physical fitness test" through tennis (Morton, 2009). This demonstrates that the Alabama Department of Education considers tennis a sufficient activity to educate on the aforementioned topics.

The USTA offers in-service tennis workshops where PE teachers can learn how to effectively implement tennis in their school. Dr. Robert Pangrazy, an expert in PE, helped to devise a user friendly curriculum that can benefit any school, even if the school has no tennis courts (USTA, 2008). The USTA offers free training, an easy to follow-curriculum, equipment assistance and technical expertise (USTA, 2008). According to the USTA, "partnering with the USTA will help you achieve your school's fitness goals and create healthy kids, foster teamwork among your students, build their self-confidence, aid in your kids' socialization, and enhance their lives by introducing them to a sport they can play for the rest of their lives." (USTA, 2008). Data generated by the USTA provides insight regarding the effectiveness of these in-service workshops. The amount of PE teachers trained by the USTA's in-service workshops rose from 2,162 in 2008 to 3,486 in 2010 (USTA, 2011). In addition, the number of curriculums distributed to schools rose from 721 in 2008 to 1,223 in 2010 (USTA, 2011). The figures gathered appear to be substantial enough to show that their work is exposing more of America's youth to tennis participation. However, as much as the USTA is trying to launch tennis into PE curriculum, there is limited information demonstrating that their pursuits are working.

Statement of the Problem

Tennis is lifetime sport that can provide many health/fitness benefits, yet the

number of frequent tennis players dropped to 4.77 million in 2010 from 5.43 million in 2009 (Goldman, 2011). With the USTA's current endeavors to implement tennis into schools nationwide, it would be expected that the number of players participating in tennis would increase. However, the 2010 Tennis Participation Survey indicates that the number of players in all age groups has decreased. Participation has also dropped in three income segments, 1) <$50,000, 2) $50,000-$100,000, and $100,000-$150000, highlighting a barrier to participation in any sport - cost. However, the USTA offers grants and discount costs for equipment. Other underlying barriers such as cultural views, teachers competence and knowledge of the sport and student interest could all be possible aspects that might cause tennis to appear infrequently in PE curriculums. It is these barriers that need to be investigated to see if they are a cause of the problem.

Applying PA to our daily lives by using a sport like tennis is a way to help fight the current epidemic crisis of obesity. Implementing tennis at an early age may help increase the quality of life of children as they age. The easiest way to expose tennis to children is by including it in schools. However, there seem to be certain barriers restricting the inclusion of tennis into the school setting. It could be that if most exposure of tennis occurs primarily around country clubs, then the likelihood of a PE teacher having knowledge and exposure to tennis is low. It is then probable that PE teachers will tend to follow their pre-conceived attitudes and beliefs towards the sport and stick to something more comfortable to teach. Additionally it is doubtful that children will be enthusiastic about an unfamiliar sport. It is possible that exposure of the teachers and students to tennis may be different in public schools versus private school and rural versus public schools. Knowing what if any differences in tennis participation and

barriers to participation exist between urban and rural schools and private versus public schools is important for development of strategies that may be helpful in increasing tennis participation in schools.

Purpose of the Study

While research exists surrounding the health benefits to tennis, research on tennis integration into PE curriculums is very limited. The overall purpose of this study is to examine the barriers of tennis participation in Alabama schools.

A current need exists to investigate if PE teachers are utilizing tennis as a means for PA in their curriculum. This study aims to investigate whether or not PE teachers in the state of Alabama are incorporating tennis into their curriculum, and to explore possible barriers that are potentially affecting participation. Are barriers, including school location (urban versus rural), athletic facilities, the teacher and student interest in tennis, and teacher knowledge of the sport causing a retraction in tennis participation?

It is hypothesized that school location will affect participation rates. Furthermore, urban schools will have less participation than suburban and rural schools. It is also expected that public schools will have less tennis play compared to private schools.

Significance of the Study

Tennis is a sport that can be enjoyed throughout the lifespan, and is an excellent exercise that can meet the ACSM PA recommendations and has proven health/fitness benefits. Given the current obesity epidemic, and the alarmingly low rates of physical activity reported in children and youth, it is crucial to identify barriers of tennis play in

school curricula in Alabama. School physical educators, tennis coaches and organizations such as the USTA will gain knowledge of how to approach the introduction of tennis to schools in a more specific manner. To our knowledge, there has been no research in this area, and this study will help fill the current void.

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