An orthopedic screening of the freshman male students enrolled in physical education classes at Montana State University

Donald Charles Steffensen

The University of Montana

Follow this and additional works at: https://scholarworks.umt.edu/etd

Let us know how access to this document benefits you.

Recommended Citation
Steffensen, Donald Charles, "An orthopedic screening of the freshman male students enrolled in physical education classes at Montana State University" (1952). Graduate Student Theses, Dissertations, & Professional Papers. 6301.
https://scholarworks.umt.edu/etd/6301
AN ORTHOPEDIC SCREENING OF THE FRESHMAN MALE STUDENTS ENROLLED IN PHYSICAL EDUCATION CLASSES AT MONTANA STATE UNIVERSITY

by

DONALD CHARLES STEFFENSEN
B.A., Montana State University, 1951

Presented in partial fulfillment of the requirements for the degree of Master of Arts

MONTANA STATE UNIVERSITY
1952
This thesis has been approved by the Board of Examiners in partial fulfillment of the requirements for the degree of Master of Arts.

Chairman of the Board of Examiners

Dean of the Graduate School

Date June 2, 1952
# TABLE OF CONTENTS

<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>PREFACE</td>
<td>vi</td>
</tr>
<tr>
<td>Chapter</td>
<td></td>
</tr>
<tr>
<td>I. THE PROBLEM</td>
<td>1</td>
</tr>
<tr>
<td>Statement of the Problem, 1</td>
<td></td>
</tr>
<tr>
<td>Importance of the Problem, 2</td>
<td></td>
</tr>
<tr>
<td>Definition of Good Posture, 5</td>
<td></td>
</tr>
<tr>
<td>Value of Good Posture, 8</td>
<td></td>
</tr>
<tr>
<td>II. ORGANIZATION FOR STUDY</td>
<td>10</td>
</tr>
<tr>
<td>Determination of Orthopedic Defects to be considered, 10</td>
<td></td>
</tr>
<tr>
<td>Selection of Screening Devices and Techniques, 12</td>
<td></td>
</tr>
<tr>
<td>Selection and Organization of Subjects to be Studied, 22</td>
<td></td>
</tr>
<tr>
<td>Establishment of Reliability in Checking, 23</td>
<td></td>
</tr>
<tr>
<td>III. PROCEDURE IN SCREENING</td>
<td>25</td>
</tr>
<tr>
<td>Introduction, 25</td>
<td></td>
</tr>
<tr>
<td>Anterior Posterior Deviations, 27</td>
<td></td>
</tr>
<tr>
<td>Lateral Deviations Observed in the Anterior View, 33</td>
<td></td>
</tr>
<tr>
<td>Lateral Deviations Observed in the Posterior View, 35</td>
<td></td>
</tr>
<tr>
<td>Ankle Deviations, 41</td>
<td></td>
</tr>
<tr>
<td>Foot Deviations, 42</td>
<td></td>
</tr>
<tr>
<td>IV. FINDINGS AND INTERPRETATION OF DATA</td>
<td>47</td>
</tr>
<tr>
<td>Criteria of Deviation, 47</td>
<td></td>
</tr>
<tr>
<td>V. SUMMARY AND CONCLUSIONS</td>
<td>68</td>
</tr>
<tr>
<td>Summary, 68</td>
<td></td>
</tr>
<tr>
<td>Conclusions, 69</td>
<td></td>
</tr>
<tr>
<td>BIBLIOGRAPHY</td>
<td>71</td>
</tr>
</tbody>
</table>
# LIST OF TABLES

<table>
<thead>
<tr>
<th>Table</th>
<th>Description</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>I.</td>
<td>Forward head</td>
<td>50</td>
</tr>
<tr>
<td>II.</td>
<td>Head (Rotated Right)</td>
<td>51</td>
</tr>
<tr>
<td>III.</td>
<td>Head (Rotated Left)</td>
<td>52</td>
</tr>
<tr>
<td>IV.</td>
<td>Head Tilted Right</td>
<td>53</td>
</tr>
<tr>
<td>V.</td>
<td>Head Tilted Left</td>
<td>54</td>
</tr>
<tr>
<td>VI.</td>
<td>Shoulder Blade Separation</td>
<td>55</td>
</tr>
<tr>
<td>VII.</td>
<td>Chest Flat</td>
<td>56</td>
</tr>
<tr>
<td>VIII.</td>
<td>Shoulder Low (Right)</td>
<td>57</td>
</tr>
<tr>
<td>IX.</td>
<td>Shoulder Low (Left)</td>
<td>58</td>
</tr>
<tr>
<td>X.</td>
<td>Pronated Ankles</td>
<td>59</td>
</tr>
<tr>
<td>XI.</td>
<td>Inverted Ankles</td>
<td>60</td>
</tr>
<tr>
<td>XII.</td>
<td>Flat Feet (Weakness of Longitudinal Arch)</td>
<td>61</td>
</tr>
<tr>
<td>XIII.</td>
<td>Flat Feet (Weakness of Transverse Arch)</td>
<td>62</td>
</tr>
<tr>
<td>XIV.</td>
<td>Kyphosis</td>
<td>63</td>
</tr>
<tr>
<td>XV.</td>
<td>Lordosis</td>
<td>64</td>
</tr>
<tr>
<td>XVI.</td>
<td>Scoliosis</td>
<td>65</td>
</tr>
<tr>
<td>XVII.</td>
<td>Composite List of Deviations</td>
<td>66</td>
</tr>
<tr>
<td>XVIII.</td>
<td>Number of Posture Deviations in Freshman Class</td>
<td>67</td>
</tr>
<tr>
<td>Figure</td>
<td>Description</td>
<td>Page</td>
</tr>
<tr>
<td>--------</td>
<td>-------------------------------------------------</td>
<td>------</td>
</tr>
<tr>
<td>1</td>
<td>Posture Screen</td>
<td>13</td>
</tr>
<tr>
<td>2</td>
<td>Foot-board in Use</td>
<td>14</td>
</tr>
<tr>
<td>3</td>
<td>Foot-mirror Test Platform</td>
<td>15</td>
</tr>
<tr>
<td>4</td>
<td>Check List (Front Side)</td>
<td>16</td>
</tr>
<tr>
<td>5</td>
<td>Check List (Reverse Side)</td>
<td>17</td>
</tr>
<tr>
<td>6</td>
<td>Using the Equipment</td>
<td>26</td>
</tr>
<tr>
<td>7</td>
<td>Lateral View</td>
<td>27</td>
</tr>
<tr>
<td>8</td>
<td>Round Shoulders</td>
<td>28</td>
</tr>
<tr>
<td>9</td>
<td>Kyphosis</td>
<td>31</td>
</tr>
<tr>
<td>10</td>
<td>Lordosis</td>
<td>32</td>
</tr>
<tr>
<td>11</td>
<td>Anterior View</td>
<td>34</td>
</tr>
<tr>
<td>12</td>
<td>Head Tilt with Rotation</td>
<td>35</td>
</tr>
<tr>
<td>13</td>
<td>Posterior View</td>
<td>36</td>
</tr>
<tr>
<td>14</td>
<td>Shoulder Low</td>
<td>37</td>
</tr>
<tr>
<td>15</td>
<td>Scoliosis</td>
<td>38</td>
</tr>
<tr>
<td>16</td>
<td>Shoulder Blade Separation</td>
<td>39</td>
</tr>
<tr>
<td>17</td>
<td>Sideward Lean</td>
<td>40</td>
</tr>
<tr>
<td>18</td>
<td>Ankle Deviations</td>
<td>41</td>
</tr>
<tr>
<td>19</td>
<td>Pes Planus</td>
<td>43</td>
</tr>
<tr>
<td>20</td>
<td>Weakness of the Transverse Arch</td>
<td>44</td>
</tr>
<tr>
<td>21</td>
<td>Pes Cavus</td>
<td>45</td>
</tr>
<tr>
<td>22</td>
<td>Posture Silhouette Photographs</td>
<td>49</td>
</tr>
</tbody>
</table>
According to the best estimates, prepared by the American Association for Health, Physical Education, and Recreation Committee, there are about four million children of school age in the United States with physical handicaps.\(^1\)

It is the responsibility of the school to contribute to the fullest possible development of the potentialities of each individual entrusted to its care.

Observation of the freshman and sophomore boys attending required physical education classes at Montana State University created, among the members of the Department of Health and Physical Education, a realization that more adequate orthopedic screening and corrective activity programs might be needed in many of the Montana Elementary and Secondary schools.

A recent study by Alex Maxwell McLain with the freshman and sophomore boys of the Missoula County High School revealed a considerable number of postural defects in boys of this age group.

As shown by the above study, "a total of 911 devia-

\(^1\)AAHPER Committee, "Guiding Principles for Adapted Physical Education," Journal of the American Association for Health, Physical Education, and Recreation, XXIII (April, 1952) No. 4, p. 15.
tions were detected in the two classes, or an average of 03.96 deviations per student and out of 230 students examined, only twelve (05.25 per cent) had perfect posture.¹

Because of the above observation and evidence, the author was inspired to conduct an orthopedic screening of the freshman male students in required physical education activities.

Such a study presents two major problems: (1) determination of the incidence of postural and foot defects among entering male students, (2) revelation of the extent of the need for an adapted program of physical education.

The author wishes to express his appreciation to the instructors of physical education classes and to those members of the freshman class of Montana State University who participated so willingly in the survey. He is also indebted to Mr. Charles F. Hertler and Mr. Vincent Wilson of the Department of Health and Physical Education, Montana State University, for their constant guidance and assistance in carrying on this study.

CHAPTER I

THE PROBLEM

Statement of the Problem

"An Orthopedic Screening of the Freshman Male Students Enrolled in Physical Education Classes at Montana State University."

The purpose of this research is to try to establish feasible evidence of the need for an adapted program of corrective physical education in the elementary and secondary school curricula by compiling data from an orthopedic screening of the freshman male students attending required physical education classes at Montana State University. The following objectives were set forth and served as a guide during the research: (1) determine whether certain defects exist and the extent to which they exist, (2) determine whether or not the students being screened for defects have been screened previously, and if defects are noted, whether they have been treated, (3) determine whether or not there is a need for a program of corrective physical education in our schools, and (4) attempt to instill a wholesome mental attitude toward good posture by stimulating interest of the students.
Importance of the Problem

A survey of the literature revealed that there have been numerous studies in this field of research at various levels of education. However, after careful investigation, the author could find no record of an organized study having been conducted at Montana State University prior to this survey.

Stafford, a noted authority on posture, states the following concerning the importance of posture:

Since the time of the early Greeks, emphasis has been laid on the desirability of "good posture." Expressions like "correct carriage and graceful step" show that the stress was largely on the aesthetic factor. And it still is; few children have escaped the command, "Throw your shoulders back!" The ungainly appearance of the child in poor posture induces the parents to try to improve this appearance by the command. A greater stress is given now, however, to the health and efficiency side to the need or normal functioning of the bodily organs gained when the various segments of the body are properly aligned.

It is probable that many a boy or girl, even today, hears the commands from teacher and parent, to "stand straight," or "stop slouching." Unfortunately, this may be the only instruction the average youth ever receives concerning good posture.

---


Many authors state that good posture and physical fitness go hand in hand. An individual with impaired organic efficiency, whether it be caused by poor posture, disease, or any other ailment, cannot be expected to live effectively without fatigue and strain.

Austin says, "The posture that defies anatomical principles is responsible for jitters, for nervous tension, for organic displacements and many of the ills which stamp their doleful story visibly on the face and body."\(^1\)

During each war considerable importance is placed upon posture and the attributes of a healthy competent body because the soldier, who wishes to prolong his life, must attain and remain in superior physical condition. With the arrival of "peace," this stress on physical fitness subsides and its importance is to a great extent forgotten.

Posture surveys have been conducted on various levels of education and the data indicates that numerous defects exist in students at all levels. Some shocking results have been revealed. Examinations indicate that only a small percentage of American youth has excellent mechanical use of the body. In a study, Dr. Robert J. Cook reported upon the orthopedic examinations of 1,393 freshmen of the classes of 1923 and 1924 at Yale University. These classes were the first to be examined under the new program

in body mechanics at Yale. Dr. Cook's report revealed the low percentage of normal posture among students at that time. He called attention to the fact that over 53 per cent had an increased anterior-posterior spinal curvature; and that over 50 per cent had some lateral curvature. He also found that 82 per cent showed evidence of pronation of the feet to some variable degree. An orthopedic examination of 11,088 Yale University freshmen covering a period of thirteen years, 1930 to 1942, was conducted by J. Stuart Wickens and Oscar W. Kiphuth of Yale University. The records show that there is a surprisingly large number of individuals at the college level who could benefit from body mechanic education and corrective work not only from the standpoint of health and physical efficiency but also from the standpoint of good appearance. Defects were found in fifty to sixty per cent of the men examined. This would seem to warrant corrective efforts.

Louisa C. Lippitt, a noted authority on posture, states:

It is a source of unending surprise to those who work in universities that so many students are allowed to reach the university age with their bodies in poor

---


postural condition. Even when a student has come from a school where attention is given to sports and exercises, there has been, in almost every case, no instruction as to posture, or even as to correct standing position.

It is common belief among the uniformed persons that the child will outgrow posture deviations. Fortunately, many mild cases of posture deviations are outgrown, while on the other hand, mild cases may develop into very serious ones if they are not corrected when the student is young and still growing. Adults with serious conditions are continually being cared for by doctors who frequently remark, "If I could only have seen this patient at an earlier date."

Definition of Good Posture

"Correct" or "good" posture involves the relationship of various body segments to each other which places them in a position which the body as a whole functions at its best.

Good posture is not concerned only with standing alignment but it also involves the mechanics of correct sitting and walking. In defining posture, one must give consideration to the problems of proper alignment in these various positions but in this survey the author has confined the study to the deviations existing in the student while assuming a standing position only.

1. Standing posture. Lee and Wagner offer the fol-

---

lowing information relative to body balance and good standing posture.

When the person is standing in correct relationship the various body segments are in line one directly above the other so that they support each other along the line of pull of gravity. This line of pull is called the long axis of the body. An imaginary line drawn from the side view through the top of the head, just back of the ear, through the center of the shoulder joint, just back of the center of hip joint, through the center of ankle joint, is a straight line if the body-segment alignment is correct. Any noticeable position of these parts either forward or backward produces a break in this imaginary line, and where the break occurs there will be strain on the body balance resulting in unnecessary fatigue and poor functioning.¹

2. Sitting posture. Another phase of posture involves proper sitting position. In considering sitting position the body should be comfortable and relaxed. The basic principle of keeping the body segments in vertical alignment over the base of support applies in sitting as well as in standing even though the base of support has been transferred to the pelvic region. Actually the support is on the ischial tuberocities of the innominate bones (the prominent bones felt in the "meaty" portion of the buttocks if you sit on your hands). The body is bent from the hips and not at the waist if the principle of "sit tall," "pull in the abdomen" is applied. The weight of the body is borne on the bony prominences of the buttocks and upper third of the thighs when the trunk is held directly above the pelvis. The lower back and buttocks should rest comfortably against

the lower back of the chair and on the rear part of the seat while the thighs are nearly horizontal. The feet and knees are close together with the feet parallel and flat on the floor.

3. Walking posture. In regard to good posture in walking, Lee and Wagner state:

The general body alignment is maintained in walking, as in standing except walking involves first the overcoming of inertia of the standing position and second a constant propelling of the body weight forward from one base of support to another with the ever present need of maintaining stability of the body by keeping the body segments centered in line with the pull of gravity over the ever changing base of support.¹

This base is exceptionally small in comparison to weight and mass which must be supported and balanced above it. The feet should point straight ahead and the weight carried largely on the outside of the feet starting at the heel and proceeding along the outer edge of the foot, across the transverse arch and ending at the large toe.

The correct walk is described as a pulling forward with one foot, then the other, drawing the body onward by a "suction" step. In the suction step the weight is kept to the front and the step is light.²

With the head erect and chest held high, the body is seemingly pulled along giving a floating, gliding effect

¹Mabel Lee and Miriam Wagner, op. cit., p. 181.
to the movement. This is accomplished if there is free
swing of the legs from the hips and an arm swing that comes
only from the body momentum.

**Value of good posture.** Good posture is more than
just an aesthetic value. It is the effective use of the
body in all of life's activities especially related to
health, success in, and enjoyment of life in general. It
is not an arbitrary factor but is based upon the effect
correct posture has upon health, strength and activities we
must encounter in solving life's problems.

Correct posture is an attribute of a few individuals.
Some people are endowed by nature with a fine physique and,
of these a few maintain good health conditions and achieve
good body mechanics with but little effort. The great run
of mankind must be educated and drilled in the proper use of
the body. The manner in which a person uses his body in all
activities determines whether he works, plays and lives ef-
fectively with a minimum of fatigue and strain.

Drew offers the following information concerning the
relationship between good health and good posture:

In the well-poised body, all the organs are held
in the best position for the proper performance of
their functions. The chest is expanded, giving room
for the lungs and heart, and thus the important pro-
cesses of respiration and circulation can be carried
on normally. There is no cramping of the stomach and
liver, while the retraction of the abdominal walls
supports the enclosed viscera in their elevated and
natural relations.¹

If the body segments are not maintained in correct alignment, muscular energy must be expended to compensate for their abnormalities and thereby a loss of efficiency is encountered.

The emphasis we place upon attaining self-respect and self-confidence in the eyes of others is strengthened by presenting a good posture. The individual who has correct posture usually gives the outward impression of buoyancy and nobility of spirit, of courage and physical vigor and of cheerfulness and hope. The spiritual and social values of good posture are dynamic if we will only give a little time and energy toward the goal of correct body mechanics.

Stafford says:

The individuals with good body mechanics comprise the greater proportion of the students who are rated high in attendance, deportment, scholastic standing, physical vigor, etc. In business today a man's mental and physical energy and alertness are portrayed largely in his posture. The majority of successful men show better skeletal alignment than the average mediocre individual. The "personal presence" which comes from correct body balance means mental poise and physical ability. Body mechanics colors one's feelings.1

---

CHAPTER II

ORGANIZATION FOR STUDY

Determination of Orthopedic Defects to be Considered

The purpose of a postural examination is to determine the mechanical efficiency of the body. The writer followed a check list similar to those suggested by George D. Deaver in Fundamentals of Physical Examination,¹ Ellen Davis Kelly in Teaching Posture and Body Mechanics,² and Lowman, Colestock and Cooper in Corrective Physical Education for Groups.³ To avoid repetition, certain items were omitted from the check list. Pelvic tilt was eliminated because the presence of lordosis, one of the items in the examination, would indicate tilted pelvis; round shoulders was eliminated because the presence of separation of the scapulae would denote this defect of round shoulders; overcarriage has been considered a defect worth mentioning in some previous studies, but the author believed that checking for

---

¹George G. Deaver, Fundamentals of Physical Examination (Philadelphia: W. B. Saunders Company, 1939), pp. 43-44.


lordosis and backward lean would give consideration to the defect of overcarriage. Checking for knocknees was omitted because, according to many orthopedic men, deviations of this nature, unless of a severe degree, would not markedly effect correct posture. The postural defects considered in this survey were carefully selected on the basis of what major factors must be regarded in determining good posture.

1. **Forward head.** This is a common defect prevalent in a great number of cases examined, therefore, the author included this deviation on the check list.

2. **Unequal shoulder level.** This is important in that it often denotes scoliosis, a lateral deviation of the spine.

3. **Shoulder blade separation.** The protrusion of the shoulder blades is a good indication that the subject is round shouldered and flat chested. These defects hinder the proper functioning of the internal organs of that region.

4. **Flat chest.** The fullness and elevation of the chest is important to note as it indicates the position of the internal organs and the respiratory efficiency.

5. **Pronation and inversion.** Pronation of the ankle is a common defect often creating a great deal of trouble in later years. Inversion of the ankle is not so prevalent but might be serious if not detected in its early stages.

6. **Flat feet.** A defect so common in people of all ages that considerable attention should be given this ailment.
7. **Kyphosis and lordosis.** These are anterior-posterior deviations often found existing alone and frequently combined and known as *kypholordosis*. If detected in youth a considerable degree of correction can be accomplished.

8. **Scoliosis.** Lateral deviations of the spine are very common and should be detected and corrected early in life for the best results.

9. **Other deviations.** Consideration will be given to deviations not mentioned above if any are prevalent.

**Selection of Screening Devices and Techniques**

The author sought equipment that has been proven valid in other posture surveys. Equipment must be selected with consideration to its reliability and objectivity. Objectivity as a criteria for posture screening is difficult to attain unless careful consideration is given to the selection of measuring devices. The measuring devices in this study were also selected in regard to economy, simplicity of design, and minimum of training for correct usage. Many types of screening equipment have been used in previous surveys but for the above reasons the following measuring devices were used.

1. **Posture screen.** This apparatus consists of a rectangular framework of wood mounted upon two pieces of wood that supports the frame in an upright position. The
frame has small brads (wire nails) driven into the wood at intervals of two inches. These nails completely encircle the rectangle and are used as an attachment for a string of dark color which is strung horizontally and vertically forming two inch squares for the judgement of segmental and symmetrical alignment of the body. Another string, white in color, is used to bisect the screen vertically. This center string serves as the vertical axis, or gravity line. The intersecting squares, made by the horizontal strings make judgement more accurate and consistent. This apparatus is six feet eight inches in height and three feet two inches in

**POSTURE SCREEN**

*FIGURE 1*
width. This piece of equipment was used to do most of the screening referred to in this research. It was valuable as it enabled the examiner to determine at a glance the alignment of the body.

2. Foot-board. A platform behind the posture screen, eighteen inches square and six inches in height, was used for the subject to stand upon while being examined. The foot-board enabled the examiner to get a good view of the feet and ankles. The subject takes a position upon the foot-board as directed while the examiner adjusts the screen to align the center gravity line at the starting point.
3. **Foot-mirror test platform.** This piece of apparatus is a low platform sixteen inches square on top side and about eighteen inches in height. The top area consists of a piece of plate glass fourteen inches square at least three eights of an inch thick or capable of supporting a man’s weight. This glass is set in flush with the wood surface that frames this platform. It must be supported underneath by at least one-half inch of wood surface around its edges. An inexpensive mirror is placed underneath the plate glass at a 45 degree angle beginning from the rear of the top surface and extending downward toward the front of the platform.

**FOOT-MIRROR TEST PLATFORM**

![Foot-mirror test platform diagram](image)

**FIGURE 3**

This foot-mirror enabled the examiner to stand or sit at a distance from the pupil standing upon the plate glass and
view in the reflecting mirror the underside of the feet while checking for deviations. A small light bulb with a reflector can be placed beneath the plate glass to light up the underside of the feet of the subject as he stands on the glass top, affording the examiner a better reflected view of the plantar surface of the subject's feet. The reflector should be turned away from the examiner in order to shield light from his eyes.

4. Check list. The examiner selected the deviations on the check list very carefully. Consideration was

<table>
<thead>
<tr>
<th>CHECK LIST (Front Side)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Case No.</td>
</tr>
<tr>
<td>Address</td>
</tr>
<tr>
<td></td>
</tr>
</tbody>
</table>

**ORTHOPEDIC SCREENING CHECK LIST**

<table>
<thead>
<tr>
<th>Degree</th>
<th>Degree</th>
</tr>
</thead>
<tbody>
<tr>
<td>HEAD, forward</td>
<td>KYPHOSIS</td>
</tr>
<tr>
<td>tilted right</td>
<td></td>
</tr>
<tr>
<td>left</td>
<td></td>
</tr>
<tr>
<td>rotated right</td>
<td></td>
</tr>
<tr>
<td>left</td>
<td></td>
</tr>
<tr>
<td>SHOULDER, right low</td>
<td></td>
</tr>
<tr>
<td>left low</td>
<td></td>
</tr>
<tr>
<td>SHOULDER BLADES, Sep</td>
<td></td>
</tr>
<tr>
<td>CHEST, Flat</td>
<td></td>
</tr>
<tr>
<td>ANKLE, pronated</td>
<td></td>
</tr>
<tr>
<td>inverted</td>
<td></td>
</tr>
<tr>
<td>FEET, flat longitudinal</td>
<td></td>
</tr>
<tr>
<td>transverse</td>
<td></td>
</tr>
</tbody>
</table>

**FIGURE 4**
given to the major factors that must be regarded in determining good posture. The author followed suggested check lists from the texts referred to on page 10. The author used the deviations mentioned earlier in the study and arranged them as shown on the preceding page.

Instructions for use of check list is as follows:
(1) Check the deviation pertaining to the student being examined, (2) one check indicates a mild deviation, (3) two checks indicates a moderate condition, (4) three checks indicates a marked condition, (5) four checks indicates a serious condition.

CHECK LIST (Reverse Side)

Encircle answer...

1. Have you ever been examined for posture or foot defects? Yes, No
   Where? School, physicians office, orthopedic clinic

2. Have you ever received treatment to correct the defect? Yes, No
   Where? School, physicians office

3. What was the defect?
   Does it still exist?
The subject was asked the above questions after the examination was completed. This information was helpful as it served as a check against the findings of the examiner, and may be useful in establishing the extent of posture examinations and corrective programs being conducted in the schools. The preceding questions were important as they helped differentiate between defects occurring from improper posture habits, disease, accidents and congenital deviations.

5. **Photographic equipment and technique.** A camera was used in this research. Pictures are very convincing to the student and parent and may also be valuable evidence whenever it becomes necessary to defend the program, or when it is necessary to request additional funds, equipment and assistance to further an adapted program.

Many authorities suggest a room in which the light is sufficient to take the pictures without the aid of artificial lighting but in this study the author was unable to secure an adequate room for that method of photography. Whenever a well lighted space is available, the natural light method of photography will prove superior as the examiner will not have to contend with the shadows cast by the strings of the posture screen. Reflected light is satisfactory, but more time must be used in shifting the lights and reflectors to overcome all shadows. Variations of height of the subject or a variance in the position of the subject necessitated
moving the lights to eliminate shadows. The author improvised reflectors from three cardboard boxes, tin foil, extension cord and some light sockets. Three number two flood bulbs were used and these were placed as follows: One on the floor at either side of subject on a line extending laterally from the screen and at a distance of four feet to the side, and the other overhead with the light being reflected in such a way that it prevents shadows of the strings from appearing on the subject. These lights may be shifted around until they meet the approval of the examiner for the best photographic results.

It is usually recommended that a camera be used that will give a rectangular exposure but the author found that any type camera with adjustable shutter, speed and lens is suitable if the pictures are going to be enlarged and masked off.

A tripod is recommended as it facilitates the moving of the camera with the least possible confusion and time.

Another recommended piece of equipment is an exposure meter to eliminate wasting time and money when photographing the subject.

Just prior to photographing the spine of a student, the author applied to the spinal processes of the vertebrae a film of cold cream and then marked the processes with lipstick or skin pencil. Wiping the spine with cold cream facilitated the removal of the lipstick or skin pencil.
6. Environment and facilities. Adequate facilities and equipment are important in conducting an examining program. All distracting factors should be eliminated, because the nature of the work requires the undivided attention of those being screened.

Space is perhaps one of the major requirements. The most satisfactory results is usually obtained in the best environment. The room should be adequate to facilitate the use of photographic equipment and also afford room for all measuring devices. A comfortable, semi-private space, near or in the examining room, for the change of clothing is very helpful and pleasant for the student being examined. A room ten feet wide and fifteen feet long would be the minimum required to conduct an examination, photograph subjects and provide room for the equipment. The testing program might be aided greatly if the room is centrally located for the convenience of the subjects.

7. Other methods of measuring posture. Many devices and tests have been used successfully from time to time but those which have proven satisfactory in the majority of surveys are the ones which offer ease of administration, ease of recording findings and are inexpensive.

In Crampton's Front Wall Test the student is required to stand facing the wall, with his toes touching, nose one inch from the wall, and hands placed in front of the thighs. A distance the width of the hand must be maintained between the thighs and the wall. In his Back Wall Test, the student
stands with his heels, hips and shoulders against the wall. He then slides his hand in the space between the wall and his lumbar spine.¹

The Schematograph is an apparatus by which the form of the student is recorded on a piece of tracing paper. The Silhouetteograph, where a photograph is taken producing a profile silhouette, is an improvement over the Schematograph.² Both of these pieces of equipment are quite satisfactory, but require elaborate installation and considerable expense.

The Conformateur is an instrument that measures anterior and posterior curvatures of the spine. This apparatus consists of a board approximately two and one half feet long with sliding metal or wooden dowels that move back and forth to fit the contour of the spine. This instrument has been proven to be a reliable measuring device for those interested in making records of posture.²

The Plumb-line is a piece of very inexpensive equipment. The plumb-line is a suspended line with a metal weight attached to one end, and is used to determine deviations in posture examinations.

The measuring instruments mentioned above are just a few of the many devices used to detect deviations in the

¹Stafford, op. cit., p. 103.
²Ibid., p. 104.
³Deaver, op. cit., p. 64.
posture of individuals.

Selection and Organization of Subjects to be Studied

The freshman male students were chosen to be examined as they were composed of a group of boys coming from a variety of high schools, predominantly Montana, which might give us an indication of the importance placed upon posture training in our own state school system. The freshman male students were chosen as they were more accessible to reach without interruption of their daily scheduled classes.

The author contacted each physical education class instructor, informing him of the study and asking for cooperation. Each instructor, during his period of instruction, was asked to send to the examining room two freshman students at the beginning of the class period. When the examiner finished with the first student, the student would return to class and inform the instructor who would send another student to the examining room. This procedure was followed until the total freshman group was reached. Conducting the program in this method did not disrupt the proper functioning of any physical education activity.

Male students in required physical education classes were scheduled for one hour each day three days a week and of this allotted time the examiner was able to acquire twenty-five minutes of each hour to conduct his survey.
Establishment of Reliability in Checking

To ascertain the reliability of his checking the author solicited the cooperation of two other persons with professional training in the corrective phase of physical education and asked them to rate three subjects in the trial group.

Each man was made familiar with the checking procedure, techniques and devices selected by the author. Each of the three examiners made an independent check on three students of the trial group. Comparisons were made of the findings of each examiner and items of particular disagreement were noted and discussed. After agreement upon pertinent points, three other students of the trial group were independently checked by the examiners. The results of this second check showed about 95 per cent agreement among the examiners. It was felt that this agreement was high enough to establish to a fair degree the reliability of judgement of the author to make further studies on the general group.

In addition to establishing the reliability of judgement of the author in his checking, the trial examination also revealed several other factors of importance. It served as an indicator of the amount of time required for each examination and also served as a basis for scheduling the examination periods. Another factor of importance brought out in this trial group was the establishing of definite
techniques in the use of measuring devices and methods of photographing the subjects.
CHAPTER III

PROCEDURE IN SCREENING

Introduction

A factor of success in dealing with the individual is winning the confidence and cooperation of the student being examined. The author attempted to do this by giving a brief resume of the reason for the examination, its procedures and to what purpose the results might be used. The posture screening can be difficult to conduct, because many of the students are subnormal physically and may have developed a pronounced complex relative to their own postures. To obtain the desired results it is advantageous not to have more than two subjects in the same room while conducting a screening check. The author found that by permitting one pupil in the room while screening another, less time was wasted in explaining what the purpose of the examination was and its procedures.

In this research, the examination of the students was made from three positions: lateral, anterior and posterior. The student stood upon the foot-board, and assumed a natural position, without tension, eyes straight ahead while the examiner shifted the screen slightly to align the white center string at the base starting point. All deviations
USING THE EQUIPMENT

FIGURE 6
from normal were recorded as described on page 46, and photographs were made of some students with abnormal or unusual deviations.

Anterior Posterior Deviations

The side or lateral view is an accepted method of determining anterior posterior deviations. From this position the examiner determines the body alignment, cervical, dorsal and lumbar curves, by noting whether the white center string of the posture screen falls on the following points: (1) in front of the external malleolus of the ankle; (2) back of the patella, or knee cap; (3) middle of the greater
trochanter; (4) tip of the shoulder, and (5) mastoid bone directly behind the ear.

1. **Shoulder alignment.** Normally, the shoulders are held as wide as possible with the tip of each pointing directly to the side and the tip of the shoulder aligned with the gravity line. A condition frequently found is the shoulders forward of the gravity line, creating the round-shouldered individual. This may be due to fatigue, the

**ROUND SHOULDERS**

*FIGURE 8*

the stretching of the trapezius, rhomboids, and serratus anterior, and the shortening of the pectoral muscles. When
the shoulders are forward of the gravity line a condition of shoulder blade (scapulae) separation is apparent. Poor posture is also apparent if the shoulders are forced backward too far making the shoulder blades appear too close to each other.

2. Chest. In correct position, the chest should extend well out in front of the shoulders with the sternum held high but not under tension. This does not mean that the diaphragm and ribs should be thrust out forcibly, but merely held up and leading the body. When the chest is held up and is well rounded, the respiratory organs can function more perfectly and the diaphragm offers more room for freely suspended organs and less crowding and sagging of the intestines takes place.

The individual possessing round shoulders and forward head is likely to be flat chested. An example of this condition can be seen on the preceding page 28 in Figure 8. This is due to a shortening of the intercostal muscles and the lengthening of the pectorals and serratus posticus superior muscles. A proper antagonistic muscle balance is necessary to overcome this defect.

3. Head and neck position. In normal posture, the chin is drawn in, head held erect, well poised and balanced upon the neck and the eyes are looking straight ahead.

Improper carriage of the head and neck commonly causes the segments in the cervical and dorsal region of the
spine to assume a position of maladjustment. The maintenance of posture when the body is out of alignment involves more work for the muscles in this region, consequently causing strain and fatigue especially in connection with vision. The position of the head is important in regards to vision, as it changes the eye level and this can affect the sight.

It must be remembered that some of the same muscles that stabilize the head and neck also help support the shoulder girdle and upper back region. A correction of forward head and neck will often help correct spinal curves existing in the cervical and dorsal area of the spine. If a condition of forward head is present, there is a shortening of the sternocleido-mastoid and intercostal muscles and a lengthening of the posterior neck muscles, namely: trapezius, scaleni and erector spinae. An example of forward head appears on page 28 in Figure 8.

Occasionally a condition of backward head exists which might create visual difficulties. The condition of forward or backward head often accompanies body lean and is detected by observing how the gravity line aligns with the points recommended for good posture.

4. Spine. Viewing the spine from a lateral aspect, should reveal a very gentle curvature, for correct posture in the spinal region. There should not be any excessive backward or forward curves. The lateral position of the student gives the examiner a view of two conditions prevalent
in many cases, namely, kyphosis and lordosis.

Kyphosis is an increased backward curvature of the spine in the thoracic region. In a few cases this exaggerated form extends to the lumbar region and is known as round back. The examiner should be careful to distinguish kyphosis from round shoulder and winged scapulae. The lengthening of the back extensor muscle groups in the thoracic region, and the shortening of the intercostal muscles may contribute to a kyphotic condition. Poor muscle tonus in the upper back region gives gravity a chance to
increase the deviations by allowing the head, neck and shoulders to slump forward. Frequently associated with fatigue slump are the conditions of kyphosis, flat and narrow chest and the pelvis that is thrust forward. A condition of kyphosis is thought to handicap certain physiologic functions of the body by cramping the respiratory and circulatory organs.

Lordosis is an exaggeration of the forward curve in the lumbar region of the spinal column. Lordosis is associated with stretched abdominal muscles, hyperextended knees.
and exaggerated pelvic tilt from the anterior posterior position. Another factor tending to produce lordosis is the shortening of muscles of the lumbar region and or hip flexors. Individuals with lordosis often suffer from back pains and it is believed to be the cause of some abdominal and respiratory disorders.

Lateral Deviations Observed in the Anterior View

For the examination the subject stands facing the examiner, in a natural posture without tension, eyes straight ahead. Body alignment is considered normal when the gravity line falls through the following points: (1) mid-way between the heels; (2) on the umbilicus; (3) on the midline of the sternum; (4) on a line bisecting the head. It will be noted that in the photograph on the following page the gravity line does fall on these points.

The following deviations may be observed in studying the subject.

1. Unequal shoulder level. The underlying cause of variations in the shoulder level may be muscular in nature. Some of the variations in shoulder level are due to injury, sternoclavicular separation, and lateral curvatures of the spine. It may even be caused by occupational habits such as continually carrying books under the same arm, hod-carrying for brick layers or perhaps holding onto the overhead strap in a subway. It should be remembered that most lateral
curvatures of the spine will cause a difference in shoulder level, and the correction of this curvature will also tend to correct the shoulder level. In the few instances when the spine is normal, and a low shoulder does exist, this deviation might be due to lack of tonus, or under development of the levator and upper fibers of the trapezius muscle. An example of unequal shoulder level from the posterior view appears on page 36 in Figure 13.

2. **Head tilt.** Usually this deviation exists if the
center string falls on all points but does not bisect the head. Sometimes it is the result of lateral deviations of the spine, auditory adjustments, faulty vision, or peculiar study habits. Often it is due to a weakness or shortness of certain neck muscles. Frequently the chin is tilted upward and to the opposite side of the tilt, creating a condition known as torticollis, or rotation of the head.

**Lateral Deviations Observed in the Posterior View**

The student assumes a position behind the posture screen with his back toward the examiner. In this position
the examiner can note the manner in which the body aligns with the strings of the screen. The marking of the spinous processes facilitates checking from this position.

POSTERIOR VIEW

FIGURE 13

The center line should fall on the following points: (1) midway between the heels; (2) at the cleft of the buttocks; (3) center on the spinous processes of the back; (4) bisect the occipital region at the base of the skull and the head.

From the posterior position, the following deviations from normal may be observed:
1. **Unequal shoulder level.** From a posterior view of the subject the examiner can pay particular attention to any relationship between a low shoulder and scoliosis (lateral curvature of the spine). A low shoulder often accompanies scoliosis, and when this spinal curve is corrected, the shoulder condition will also be corrected. This deviation was explained in more detail on page 33.

![SHOULDER LOW](image)

**FIGURE 14**

2. **Spinal deviations.** Scoliosis is a lateral curvature of the spine and can be most easily detected in the posterior view. Scoliosis may be of two types, namely, "C"
curve and "S" curve. A uniform curvature, beginning at the pelvis and extending to the shoulders, is the "C" type scoliosis. The "S" curve type may curve to the right or left in the lumbar region, and to the opposite in the thoracic region. As mentioned previously, head tilt and unequal shoulder may be associated with scoliosis.

SCOLIOSIS

"C" Curve

"S" Curve

FIGURE 15

3. Shoulder blade separation. This deviation becomes apparent when the shoulders are forward of the gravity line. When the tips of the shoulders are abducted, the shoulder blades (scapulae) appear separated. The protrusion
of the vertebral border is more easily observed from the posterior view. A subject with shoulder blade separation should also be observed in the lateral view as shoulder blade separation is associated with round shoulders, flat chest and kyphosis. These above deviations cause a cramping of the respiratory and circulatory organs and proper functioning can not be accomplished.

SHOULDER BLADE SEPARATION

FIGURE 16

4. Body lean. Any lean away from the center line is easily detected. Normally the head is balanced upon the
corresponding body segments below but in body lean the head may be carried to the opposite side of the lean in an effort to regain balance and secure proper vision. Occasionally the spine will be curved when this lean is present. A shortened lower extremity or disturbance of the feet is compensatory to this condition. A subject may have body lean to either side, forward and occasionally backward lean. These deviations from the normal often lead to compensatory deviations of a more serious nature. Forward or backward lean might lead up to the condition of lordosis and kyphosis.

SIDeward lean

FIGURE 17
Ankle Deviations

These deviations are most easily detected by noting the alignment of the Achilles tendon, which should be nearly perpendicular in the normal ankle. If the tendon curves inward, pronation (eversion) is present, and if it curves outward, supination (inversion) is present.

ANKLE DEVIATIONS

Pronation  Supination

FIGURE 18

The posture screen aids in discovering ankle deviations. The vertical strings on the posture screen can be utilized to recognize improper alignment of the ankle with the rest of the body. The center line or any vertical string which
is aligned on the leg should pass from the anterior spine of
the ilium, down the middle of the ankle joint, and to a point
on the foot between the first and second toes. This can be
noted when the subject is viewed from an anterior position.

1. Pronation. The bowing in of the tendon places
additional strain on the medial longitudinal, and transverse
arch of the foot. There is a prominence of the internal
malleolus, and, in severe cases, the scaphoid bone is allow­
ed to drop to the same level as the heel and ball of the
foot. Pronation of the ankles causes the student to walk
with a gait which has lost much of its spring and drive.
When this condition is present, there is a weakening of the
anterior and posterior tibial muscles, and a shortening of
the peroneal muscles.

2. Supination. The bowing out of the tendon causes
much of the weight of the body to be supported on the outer
border of the foot. Supination is not as common as the
everted foot and does not effect normal foot movements as
noticeably as does eversion.

Foot Deviations

Since the feet serve as the foundations for the
body, it is particularly important that the body be aligned
in its proper weight-bearing position.

A method of determining foot deviations known as
the Foot Mirror Test, which was explained in detail on
page 15, was developed by George G. Deaver. This device for testing is significant as it enabled the examiner to check visually the weight bearing surface of the plantar area of the feet. The under surface of the feet bearing the weight of the student appears white while the non-weight bearing surface shows up slightly red. The author used this method of testing for flat feet and discovered that this measuring device saved a great deal of time. The foot mirror is a valuable piece of apparatus in that it simplifies the examination of flat feet and it is relatively easy to photograph deviations by shooting the surface outlined upon the mirror.

1. Pes planus. This condition, ordinarily known as

PES PLANUS

\[\text{FIGURE 19}\]

\[\text{Deaver, op. cit., p. 89.}\]
"flat feet," is very common in adult life. When the bones of the feet and ankles are in their normal positions, they are arranged so as to form two arches, which afford certain mechanical advantages in the use of the feet. Whenever these bones depart from their customary position, the arches tend to flatten, or even disappear. If this occurs, the weight of the body falls heavily on the part of the foot directly under the leg bones, rather than being distributed by the arches to the proper points of bearing. Such a condition is often accompanied by fatigue. When the arch of the foot is flat, the posterior tibial, flexor hallucis longus, and flexor digitorum longus muscles have become lengthened.

Occasionally a weakness of the transverse arch,

WEAKNESS OF THE TRANSVERSE ARCH

FIGURE 20
which sometimes leads to serious foot complications, is observed. The resulting pain often incapacitates an individual to the extent that he is even unable to walk. Thick callouses are usually found on the sole of the foot, the metatarsal arch is flat on the floor, and the tips of the toes are pressed against the sole of the shoe. This weakness is due to the stretching of the plantar ligaments and muscles.

2. **Pes cavus.** In an instance of this kind, a very high arch is apparent with short plantar structures, and

![Pes Cavus](image)

**FIGURE 21**

the toes are cocked up. The condition of pes cavus is often hereditary and is believed to be a condition of muscular imbalance due to a nervous irritation. Pes cavus is observed in the mirror in the form of two white areas made by the
weight of the body falling only on the heel area and ball of the foot. There is a space between each point that does not contact the mirror surface.
CHAPTER IV

FINDINGS AND INTERPRETATION OF DATA

A major objective of this research was to determine, by conducting a survey of the freshman boys enrolled in physical education classes at Montana State University, if certain defects exist and the extent to which they exist. Each boy in the Freshman Class was screened according to the procedure outlined in Chapter III.

An effort was made, first to observe any deviation existing and, second to classify the deviation in categories, according to their severity. In order that the screening be as accurate and consistent as possible, the standards of appraisal listed below were used.

Criteria of Deviation

First degree. Any slight variation from the normal.

Second degree. Any variation from the normal greater than slight, but not great enough to handicap the student's normal activity and general appearance.

Third degree. Any variation from the normal greater than the second degree and severe enough that it may noticeably effect the student's normal activity and general appearance.
Fourth degree. Any pronounced variation from normal greater than third degree.

Various texts suggested different methods of grading or checking the results of the examinations. George G. Deaver\(^1\) used the excellent, good, fair and poor classification while Ellen Davis Kelly\(^2\) used the 1, 2 and 3 grading scale. Numerous systems exist and perhaps they are selected for their convenience and clarification of grading. The author chose the method on pages 16 and 17 of this thesis for its clarity and convenience and because it closely resembles Deaver's method. Illustrations of degree of variation from normal in standing posture are shown in Figure 22, page 49.

\(^1\)Deaver, *op. cit.* \(p. 61\).

\(^2\)Kelly, *op. cit.* \(p. 50\).
University of Southern California

DEPARTMENT OF PHYSICAL EDUCATION

POSTURE SILHOUETTE PHOTOGRAPHS
(Part of Entering Physical Examination)
NOTE STRAIGHT AND ZIGZAG POSTURE LINES

FIGURE 22

GOOD
1. Head, trunk and thigh in straight line.
2. Chest high, and forward.
3. Abdomen flat.

FAIR
1. Head forward.
2. Abdomen prominent.
3. Exaggerated curve in upper back.
4. Slight hollow back.

POOR
1. Relaxed (fatigue) posture.
2. Head forward.
3. Abdomen relaxed.
4. Shoulder blades prominent.
5. Hollow back.

VERY POOR
1. Head forward badly.
2. Very exaggerated curve upper back.
3. Abdomen relaxed.
5. Hollow back.
TABLE I
FORWARD HEAD

<table>
<thead>
<tr>
<th>Degree</th>
<th>Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>1st degree</td>
<td>75</td>
</tr>
<tr>
<td>2nd degree</td>
<td>37</td>
</tr>
<tr>
<td>3rd degree</td>
<td>13</td>
</tr>
<tr>
<td>4th degree</td>
<td>0</td>
</tr>
<tr>
<td>Total deviations</td>
<td>125</td>
</tr>
<tr>
<td>Number examined</td>
<td>159</td>
</tr>
<tr>
<td>Per cent with deviations</td>
<td>78.4</td>
</tr>
</tbody>
</table>

The author's findings on the deviation above correlates closely with those found in the survey conducted by Alex Maxwell McLain at the Missoula County High School in 1948. McLain's report shows the per cent with deviation to be 71.5.

---

1Alex Maxwell McLain, *op. cit.*, p. 36.
### TABLE II

**HEAD (ROTATED RIGHT)**

<table>
<thead>
<tr>
<th>Degree</th>
<th>Count</th>
</tr>
</thead>
<tbody>
<tr>
<td>1st</td>
<td>3</td>
</tr>
<tr>
<td>2nd</td>
<td>0</td>
</tr>
<tr>
<td>3rd</td>
<td>0</td>
</tr>
<tr>
<td>4th</td>
<td>0</td>
</tr>
<tr>
<td>Total</td>
<td>3</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Count Examined</th>
<th>159</th>
</tr>
</thead>
<tbody>
<tr>
<td>Per cent with deviations</td>
<td>01.8</td>
</tr>
</tbody>
</table>

Apparently this defect is not of major importance. It is mentioned briefly in literature but the author could not find reference to it in postural surveys. It would seem to bear some importance because of the ill effects of this position of the head to proper vision. Poor vision and hearing may contribute to rotation of the head to either side.
### TABLE III

#### HEAD (ROTATED LEFT)

<table>
<thead>
<tr>
<th>Degree</th>
<th>Count</th>
</tr>
</thead>
<tbody>
<tr>
<td>1st degree</td>
<td>7</td>
</tr>
<tr>
<td>2nd degree</td>
<td>0</td>
</tr>
<tr>
<td>3rd degree</td>
<td>0</td>
</tr>
<tr>
<td>4th degree</td>
<td>0</td>
</tr>
<tr>
<td>Total deviations</td>
<td>7</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Number examined</th>
<th>159</th>
</tr>
</thead>
<tbody>
<tr>
<td>Per cent with deviations</td>
<td>04.4</td>
</tr>
</tbody>
</table>

The occurrence of rotation of the head to the left is slightly greater than twice that of rotation of the head to the right. The author was unable to reach any conclusion for this occurrence.
### Head (Tilted Right)

<table>
<thead>
<tr>
<th>Degree</th>
<th>Count</th>
</tr>
</thead>
<tbody>
<tr>
<td>1st</td>
<td>37</td>
</tr>
<tr>
<td>2nd</td>
<td>0</td>
</tr>
<tr>
<td>3rd</td>
<td>0</td>
</tr>
<tr>
<td>4th</td>
<td>0</td>
</tr>
<tr>
<td>Total</td>
<td>37</td>
</tr>
</tbody>
</table>

- **Number examined**: 159
- **Per cent with deviations**: 22.6

Head tilt to the right occurred twice as frequent in this survey as in a survey conducted by Lowman and Nicholls,¹ but this may be due to the age difference of the subjects examined. Lowman and Nicholls examined a group of children ranging in age from five to fourteen.

---

¹Lowman, Colestock and Cooper, *op. cit.*, p. 12.
<p>| | | | | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1st degree</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>21</td>
</tr>
<tr>
<td>2nd degree</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1</td>
</tr>
<tr>
<td>3rd degree</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0</td>
</tr>
<tr>
<td>4th degree</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0</td>
</tr>
<tr>
<td>Total deviations</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>22</td>
</tr>
<tr>
<td>Number examined</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>159</td>
</tr>
<tr>
<td>Per cent with deviations</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>13.8</td>
</tr>
</tbody>
</table>
TABLE VI

SHOULDER BLADE SEPARATION

<table>
<thead>
<tr>
<th>Degree</th>
<th>Count</th>
</tr>
</thead>
<tbody>
<tr>
<td>1st</td>
<td>38</td>
</tr>
<tr>
<td>2nd</td>
<td>5</td>
</tr>
<tr>
<td>3rd</td>
<td>1</td>
</tr>
<tr>
<td>4th</td>
<td>0</td>
</tr>
<tr>
<td>Total</td>
<td>44</td>
</tr>
<tr>
<td>Number</td>
<td>159</td>
</tr>
<tr>
<td>Per cent</td>
<td>27.6</td>
</tr>
</tbody>
</table>

The above table shows a 3.4 per cent greater occurrence of shoulder blade separation (round shoulders are indicated in this deviation) than J. Stuart Wickens and Oscar W. Kiphuth found in their study of Yale University Freshmen.

The author did note that this condition was more noticeable among boys who did not have heavy musculature of the shoulder girdle and back.

TABLE VII
CHEST (FLAT)

<table>
<thead>
<tr>
<th>Degree</th>
<th>Count</th>
</tr>
</thead>
<tbody>
<tr>
<td>1st degree</td>
<td>41</td>
</tr>
<tr>
<td>2nd degree</td>
<td>15</td>
</tr>
<tr>
<td>3rd degree</td>
<td>3</td>
</tr>
<tr>
<td>4th degree</td>
<td>0</td>
</tr>
<tr>
<td>Total deviations</td>
<td>59</td>
</tr>
<tr>
<td>Number examined</td>
<td>159</td>
</tr>
<tr>
<td>Per cent with deviations</td>
<td>37.1</td>
</tr>
</tbody>
</table>

In comparison to several other surveys conducted on the college and high school level the above table indicates 10 per cent more students with deviations of the chest. This may be due to a more critical evaluation on the part of the examiner.
TABLE VIII

SHOULDER LOW (RIGHT)

<table>
<thead>
<tr>
<th>Degree</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1st</td>
<td>64</td>
</tr>
<tr>
<td>2nd</td>
<td>11</td>
</tr>
<tr>
<td>3rd</td>
<td>1</td>
</tr>
<tr>
<td>4th</td>
<td>0</td>
</tr>
<tr>
<td>Total</td>
<td>76</td>
</tr>
</tbody>
</table>

Number examined 159
Per cent with deviations 47.7

The greater number of students with a low right shoulder, rather than a low left shoulder, might indicate occupational adjustments and improper study habits because of the larger number of people being right handed rather than left handed.
<table>
<thead>
<tr>
<th>Degree</th>
<th>Count</th>
<th>Total Deviations</th>
<th>Number Examined</th>
<th>Per cent with deviations</th>
</tr>
</thead>
<tbody>
<tr>
<td>1st degree</td>
<td>10</td>
<td>12</td>
<td>159</td>
<td>07.5</td>
</tr>
<tr>
<td>2nd degree</td>
<td>2</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3rd degree</td>
<td>0</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4th degree</td>
<td>0</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
TABLE X

PRONATED ANKLES

1st degree ........................................ 62
2nd degree ........................................ 2
3rd degree ........................................ 0
4th degree ........................................ 0
Total deviations .................................. 64
Number examined .................................. 159
Per cent with deviations .......................... 40.2

If body weight is distributed properly, the Achilles Tendon, or heel cord, will be straight. Although the greater number of students possess pronated ankles of a first degree we might assume there is greater need for attention to weak foot conditions. Such conditions if not corrected could cause misery, discomfort and might even incapacitate the individual.
TABLE XI

INVERTED ANKLES

<table>
<thead>
<tr>
<th>Degree</th>
<th>Count</th>
</tr>
</thead>
<tbody>
<tr>
<td>1st degree</td>
<td>3</td>
</tr>
<tr>
<td>2nd degree</td>
<td>0</td>
</tr>
<tr>
<td>3rd degree</td>
<td>0</td>
</tr>
<tr>
<td>4th degree</td>
<td>0</td>
</tr>
<tr>
<td>Total deviations</td>
<td>3</td>
</tr>
</tbody>
</table>

Number examined | 159

Per cent with deviations | 0.18

The number of students with inverted ankles (bowing out) is relatively small but the strain on the muscles and ligaments supporting the arch is comparable to that of pronated ankles.
TABLE XII

FLAT FEET (WEAKNESS OF LONGITUDINAL ARCH)

<table>
<thead>
<tr>
<th>Degree</th>
<th>Count</th>
</tr>
</thead>
<tbody>
<tr>
<td>1st</td>
<td>47</td>
</tr>
<tr>
<td>2nd</td>
<td>12</td>
</tr>
<tr>
<td>3rd</td>
<td>1</td>
</tr>
<tr>
<td>4th</td>
<td>0</td>
</tr>
<tr>
<td>Total</td>
<td>60</td>
</tr>
<tr>
<td>Number Examined</td>
<td>159</td>
</tr>
<tr>
<td>Per cent with deviations</td>
<td>37.7</td>
</tr>
</tbody>
</table>

In this study the author used a foot mirror to screen for flat feet while Alex Maxwell McLain\(^1\) used a subjective method of testing. The results of the two surveys are approximately the same.

\(^1\)McLain, *op. cit.*, p. 46.
<table>
<thead>
<tr>
<th>Degree</th>
<th>Count</th>
</tr>
</thead>
<tbody>
<tr>
<td>1st</td>
<td>3</td>
</tr>
<tr>
<td>2nd</td>
<td>0</td>
</tr>
<tr>
<td>3rd</td>
<td>0</td>
</tr>
<tr>
<td>4th</td>
<td>0</td>
</tr>
<tr>
<td>Total</td>
<td>3</td>
</tr>
<tr>
<td>Number Examined</td>
<td>159</td>
</tr>
<tr>
<td>Percent with Deviations</td>
<td>0.18</td>
</tr>
</tbody>
</table>

It is apparent by the table above that a weakness of the transverse arch is uncommon but the detection and correction of it is important as the function of the transverse arch is to prevent jarring of the spine, give stability in walking and spring to the step.
TABLE XIV
KYPHOSIS

<table>
<thead>
<tr>
<th>Degree</th>
<th>Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>1st degree</td>
<td>67</td>
</tr>
<tr>
<td>2nd degree</td>
<td>14</td>
</tr>
<tr>
<td>3rd degree</td>
<td>0</td>
</tr>
<tr>
<td>4th degree</td>
<td>0</td>
</tr>
<tr>
<td>Total deviations</td>
<td>81</td>
</tr>
</tbody>
</table>

Number examined: 159
Per cent with deviations: 50.9

The percentage of students with kyphosis as indicated by the above table compares favorably with a study conducted at Yale University by Dr. Robert J. Cook. Dr. Cook's survey revealed 50 per cent of the freshman students had some degree of kyphosis.

---

TABLE IV
LORDOSIS

<table>
<thead>
<tr>
<th>Degree</th>
<th>Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>1st degree</td>
<td>43</td>
</tr>
<tr>
<td>2nd degree</td>
<td>7</td>
</tr>
<tr>
<td>3rd degree</td>
<td>1</td>
</tr>
<tr>
<td>4th degree</td>
<td>0</td>
</tr>
<tr>
<td>Total deviations</td>
<td>51</td>
</tr>
<tr>
<td>Number examined</td>
<td>159</td>
</tr>
<tr>
<td>Per cent with deviations</td>
<td>32.0</td>
</tr>
</tbody>
</table>

The percentage of students with a lordosis deviation of the first degree is slightly larger than shown in some other surveys but the total percentage of deviations is approximately the same. Very few students with marked degree of lordosis were found in this study. Mild cases of lordosis do not seriously hamper the functions of the student.
TABLE XVI

SCOLIOSIS

1st degree ........................................... 43
2nd degree ............................................. 6
3rd degree ............................................. 0
4th degree ............................................. 0
Total deviations ...................................... 49
Number examined ..................................... 159
Per cent with deviations ............................. 30.8

The extent of lateral deviations of the spine might indicate the lack of proper posture training in the home and school.
## TABLE XVII

**COMPOSITE LIST OF DEVIATIONS**

<table>
<thead>
<tr>
<th>Deviation</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Forward head</td>
<td>125</td>
</tr>
<tr>
<td>Rotated head</td>
<td>10</td>
</tr>
<tr>
<td>Tilted head</td>
<td>58</td>
</tr>
<tr>
<td>Shoulder low</td>
<td>88</td>
</tr>
<tr>
<td>Shoulder blade separation</td>
<td>44</td>
</tr>
<tr>
<td>Chest flat</td>
<td>59</td>
</tr>
<tr>
<td>Pronated ankles</td>
<td>62</td>
</tr>
<tr>
<td>Inverted ankles</td>
<td>3</td>
</tr>
<tr>
<td>Feet (flat)</td>
<td>63</td>
</tr>
<tr>
<td>Back (kyphosis)</td>
<td>81</td>
</tr>
<tr>
<td>Back (lordosis)</td>
<td>51</td>
</tr>
<tr>
<td>Back (scoliosis)</td>
<td>49</td>
</tr>
<tr>
<td>Backward lean</td>
<td>2</td>
</tr>
<tr>
<td>Sideward lean</td>
<td>12</td>
</tr>
<tr>
<td>Pes cavus</td>
<td>13</td>
</tr>
<tr>
<td>Forward lean</td>
<td>18</td>
</tr>
<tr>
<td>Flat back</td>
<td>2</td>
</tr>
<tr>
<td>Round back</td>
<td>1</td>
</tr>
<tr>
<td>Total deviations</td>
<td>741</td>
</tr>
<tr>
<td>Number examined</td>
<td>159</td>
</tr>
<tr>
<td>Average deviations per student</td>
<td>4.6</td>
</tr>
<tr>
<td>Number with good to perfect posture</td>
<td>10</td>
</tr>
<tr>
<td>Per cent with good to perfect posture</td>
<td>0.063</td>
</tr>
<tr>
<td>Posture Deviation</td>
<td>20</td>
</tr>
<tr>
<td>-----------------------------------</td>
<td>----</td>
</tr>
<tr>
<td>Shoulder blade separation</td>
<td></td>
</tr>
<tr>
<td>Forward head</td>
<td></td>
</tr>
<tr>
<td>Rotated head</td>
<td></td>
</tr>
<tr>
<td>Tilted head</td>
<td></td>
</tr>
<tr>
<td>Shoulder low</td>
<td></td>
</tr>
<tr>
<td>Chest flat</td>
<td></td>
</tr>
<tr>
<td>Pronated ankles</td>
<td></td>
</tr>
<tr>
<td>Inverted ankles</td>
<td></td>
</tr>
<tr>
<td>Feet (flat)</td>
<td></td>
</tr>
<tr>
<td>Kyphosis</td>
<td></td>
</tr>
<tr>
<td>Lordosis</td>
<td></td>
</tr>
<tr>
<td>Scoliosis</td>
<td></td>
</tr>
<tr>
<td>Backward lean</td>
<td></td>
</tr>
<tr>
<td>Sideward lean</td>
<td></td>
</tr>
<tr>
<td>Pes cavus</td>
<td></td>
</tr>
<tr>
<td>Forward lean</td>
<td></td>
</tr>
<tr>
<td>Flat back</td>
<td></td>
</tr>
<tr>
<td>Round back</td>
<td></td>
</tr>
</tbody>
</table>
CHAPTER V

SUMMARY AND CONCLUSIONS

Summary

Reports of recent orthopedic surveys estimate approximately four million children of school age in the United States with physical handicaps.

A study conducted at Missoula County High School in 1948 revealed a considerable number of postural defects in boys of high school age.

From the questionnaire on the reverse side of the examination check list the author disclosed that very little posture screening is being done in our schools and adapted and corrective physical education in our schools is negligible. Only eighteen students had been examined for posture deviations prior to this orthopedic screening. Of the eighteen students examined previously, sixteen were screened in school, one in an orthopedic clinic and one by a private physician.

Missoula County High School accounted for fourteen of the eighteen examined students. The students examined in Missoula County High School received corrective exercises for a short period of time by the research student.
Table I through XVIII, in this survey, gives the summary of the results of the orthopedic examination of 159 Montana State University freshmen enrolled in required physical education courses. The record shows that there is a surprisingly large number of individuals at the college level who might benefit from body mechanic education and corrective work not only from the standpoint of health and efficiency but also from that of good appearance.

According to the author's interpretation, of the 159 students examined, only one student or .062 per cent had excellent posture, and only ten or .06 per cent possessed good posture.

Table XVII shows an average of 4.6 deviations per student as compared to an average of 3.96 per student reported in McLain's survey at the Missoula County High School.

The data compiled in this survey compares favorably with many surveys conducted on the college level.

Conclusions

This study was primarily concerned with diagnosis of postural defects but there is sufficient evidence contained in this research to enable the author to arrive at the following conclusions: (1) numerous defects exist in the

1McLain, op. cit., p. 36.
boys of the freshman class, (2) simple and efficient screening devices and techniques were adequate in the recognition of posture deviations, (3) the interest of the students being screened can be secured, (4) there is definite need for a posture correction program in the curricula of all schools, (5) very little posture screening is being done in our schools, (6) adapted and corrective physical education in our schools is negligible.

In view of the prevalence of faulty body mechanics, and in view of the desirability of good body mechanics, it is obvious that the matter merits more attention in our educational system. Throughout school life, the physical development of the student should be closely followed. It is only natural that physical education should consider the important problem of posture as one of its own. The health service as part of its program should provide an orthopedic examination for each student and a definite follow-up program for the correction of postural defects. A postural record should be on file. Each student might be screened twice during the school year as this offers the opportunity to evaluate the posture training program and to note any progress in the individual. An attempt should be made to make good posture habitual with every student. Physical education activities without attention to body mechanics cannot be relied upon to promote good posture.
AAHPER Committee, "Guiding Principles for Adapted Physical Education," *Journal of the American Association for Health, Physical Education and Recreation*, XXIII, No. 4 (April, 1952), Pp. 64.


