An evaluation of diagnostic equipment which must be purchased by optometry students

Joe L. Upchurch
Pacific University
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Abstract
This material deals with student's response to a survey as to quality and quantity of their retinoscope, ophthalmoscope, trial lens set and trial frame. Also basic use and features of these instruments are included. Other less expensive equipment was surveyed to see if students actually possessed it.

Degree Type
Thesis

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AN EVALUATION OF
DIAGNOSTIC EQUIPMENT WHICH MUST
BE PURCHASED BY OPTOMETRY STUDENTS

A PAPER PRESENTED TO THE
FACULTY OF THE COLLEGE OF OPTOMETRY
PACIFIC UNIVERSITY
FOREST GROVE, OREGON

IN PARTIAL FULFILLMENT OF
THE REQUIREMENTS FOR THE DEGREE
DOCTOR OF OPTOMETRY

JOE L. UPCHURCH
AUTHOR

JAMES E. PETERSON, O.D.
ADVISOR
ACKNOWLEDGEMENTS

My deepest appreciation is extended to Dr. James E. Peterson for his criticism, suggestions and guidance in this project. Also, I would like to thank my typist, Robin White.
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ABSTRACT

This material deals with student's response to a survey as to quality and quantity of their retinoscope, ophthalmoscope, trial lens set and trial frame. Also basic use and features of these instruments are included. Other less expensive equipment was surveyed to see if students actually possessed it.
INTRODUCTION

Students entering the College of Optometry in the first year are required to purchase diagnostic equipment which is expensive and complex. They do not have the technical competence that early to properly evaluate the advantages, disadvantages and cost factors that would allow them to intelligently make decisions as to which of the competing products would be best for them.

It is the purpose of this paper to list the functions, features, advantages, disadvantages and cost factors of the equipment and also to discuss the clinical usage of the equipment in order that the beginning student may use this information in his evaluation of which product to buy.

It is not the purpose of this paper to teach students how to use a retinoscope, an ophthalmoscope, a trial lens kit or any of the diagnostic equipment evaluated in this project. It is however, intended to give them an idea of what these diagnostic instruments do and how their use is applicable in conducting a basic optometric examination. It is hoped that the students will gain knowledge of how prior students acquired their instruments and how the students were impressed with the performance of the instruments.

This paper will try to be informative regarding what instruments are available and where to purchase the instruments.
PROCEDURE

The list of required equipment for Pacific University Optometry students is as follows; *retinoscope, *direct ophthalmoscope, transilluminator, *trial lens set, schematic eye, ocluder, clinic jacket, tape measure, P.D. ruler, near point card, hole card, cross grid card, .62m card, single line card, fixation beads, pointers, keystone stereo cards, lens clock, *trial frame, electronic calculator "four function", Amsler grid, measuring magnifier, contact lens spinner, rubber c.l. holder, diagnostic set - 10 contact lens, red-green glasses, Bagolini striated lenses, Worth 4 dot test, Polaroid glasses, small prism bar, loose prism set and dispensing tools. Only items marked with an asterisk (*) will be investigated.

After having scrutinized this list, those instruments that were costliest were selected for investigation.

Product information catalogues and brochures were obtained from Welch Allyn, American Optical, Keeler Optical Products Inc., Precision Optical Co., B&L Division, and House of Vision Incorporated. (See Appendix II for Feature Outline.)

A questionnaire was drawn up and distributed to the third and fourth year optometry students at Pacific University, (Appendix I). This questionnaire was designed to assess each of the company's trial lens set, ophthalmoscope, retinoscope and trial frame as available. The areas of interest were, 1) What are their advantages and disadvantages, 2) What are their costs, 3) What kind of guarantee do they offer, 4) What model or make of instruments do the students have, 5) What was their general impression of the instrument they had, 6) And how did they purchase it?

The questionnaire was returned by the students and the answers were not without ambiguity. For example, when the instructions stated "check one below" there were often times more than one response. There were also times when students only gave a partial response. In any case, all data were tallied. Results were tabulated and analysed.
RESULTS

There were 135 questionnaires sent out. 87 were filled out or partially filled out and returned. This represented a 64.4% return rate. 76 were sent to 3rd year and 59 to 4th year students. The return was 46 and 41 respectively making a 60.5% return for third year and a 69.5% return for 4th year students.

Of the respondents, 73 were male and 14 were female. 69 were between 20-30 years, 14 were between 30-40 years and two were over 40 years old. Four individuals did not respond to age.

Four students were on military scholarship, 36 were on WICHE, nine were past or present G.I. bill recipients and 35 students responded (no) to all three categories. Three people indicated more than one form of assistance and three people did not respond to the questions.

In response to the question "What make(s) or model(s) of ophthalmoscope do you own"? (See Graph II A-C) 63 indicated Welch Allyn, 27 Propper, eight American Optical, one Keeler, and one Neitz. 11 respondents had more than one ophthalmoscope and no student indicated more than two. Additionally, 56 responses were Halogen, 68 were rechargeable handles and 18 were battery operated handles.

When asked "What make(s) or model(s) of retinoscope do you own"? (See Graph I A-D) 57 responses were Welch-Allyn, 24 Propper,14 Copeland, five American Optical and one Keeler. 14 students had more than one retinoscope. None indicated more than two. Additionally, 79 indicated streak, three spot, 33 Halogen, 67 rechargeable handle, 14 battery operated handle. Here, 96.3% of the responders owned a streak retinoscope.

The number of responses to "How did you purchase or acquire your ophthalmoscope"? were: five - given to me, 64 acquired through Pacific University Bookstore; 22 acquired through group purchase; six acquired through self-investigation; five other. 62.4% of the retinoscopes were purchased from the Pacific University Bookstore.

In response to the statement, "As an afterthought, check the below statement which is most appropriate regarding your purchase of diagnostic instruments". 45 indicated that they would purchase the same unit. This was 46.4% of all responses to this question. 16 or 16.5% indicated they should have done more research before they purchased. Only one of the respondents reflected that they would like to have been less pressured by salesperson(s). This is a mere 1.1%. In the author's opinion this represents a compliment to all the salespersons.
the responses were that they had no idea in advance, of what they wanted and how to go about getting it. Only two students or a 2.3% indicated that they knew well in advance what they wanted and how to go about getting it. There were 97 responses, hence ten more responses than responders.

In response to the statement "My final decision for selecting my particular make(s) was heavily influenced by": low cost, there were 25 responses; high cost, zero responses; the feel of the instrument, 28; the optical properties and accessories, 29; the guarantee, 14; other, 5. There were 121 responses.

In response to the statement, "Rate your retinoscope based on your experience with it". Indicate which is being rated first purchased or 2nd purchased. (See Graph I, A-D)

Likewise, to the same statement regarding the ophthalmoscope. (See Graph II, A-C)

In response to the statement, "Which of the following apply to your trial lens kit"? 51 indicated plus and minus cylinders, 31 indicated minus cylinders only, 20 responded corrected curves, 17 Marco and three American Optical Tillyer Masterpiece, 51 reported Western Optical, six indicated Japanese model, and six students indicated that they did not have one. Three students had more than one set - one old and one new, and two people did not indicate cylindrical form.

In response to the statement, "Rate your trial lens set". (See Graph III A-E for ratings and makes.) Additionally, there were 78 responses, 16 responded that their lens set was adequate for school only, 60 responded that their lens set was good for school and private practice. This constitutes 77% of the responses. Two individuals (2.6%) of respondents thought that their trial lens set was not good for school or private practice. Nine people did not respond to the question.

When asked to indicate the single influence which prompted you to buy your lens set. There were 91 responses, 56 (61.5%) responses were to low cost. There were no responses to high cost. Six students wanted something only for school. 24 students wanted something for school and private practice. Only one student was influenced by an upper classmate. Five students checked others.

When asked "What was the approximate price of your lens set"? There were 83 responses, 58 (70%) people reported under $300.00. 11 individuals responded to $300.00-$400.00. Six students paid between four and five hundred dollars, four students paid between five and six hundred dollars. One student paid between six and eight hundred dollars and three students paid over $800.00. The general trend here is an inverse relationship between number of students purchasing and number of dollars spent.

When asked "What make or model of trial frame do you have"? There were 83 responses. 39 had Marco, 18 had
Topcon, 10 indicated Japanese models, three American Optical, 13 indicated others. (See Graph IIIA-C, and Table I.) As a matter of interest currently nearly all models of trial frames are made in Japan and there is little difference between brand names. Also Topcon and Marco are made in Japan.

In response to the question "What was the approximate price of your trial frame?" There were 80 responses. 38 students reported under $70.00. 20 students paid $70.00-$80.00. Seven students paid $80.00-$90.00 and 15 students reported over $90.00. Three students who had trial frames did not respond.

When asked "Rate your trial frame", 83 students responded. (See Graph IV and Table 2 for data.)

Concerning the data for the statement please check the following if you have them. A complete evaluation was not warranted. But a general trend showed that most 4th year students have all or nearly all of the materials. Third year students had most of the materials, save for that material associated with strabismus and V.T. diagnosis and training. For example, red green glasses with handle and elastic, Bagolini striated lenses, Worth 4 dot test, Poloroid glasses and small prism bars were not often checked by third year students. Also the Amsler grid was most often left unchecked than checked by both 3rd and 4th year students. It is to be expected that the third year students would not have materials primarily used in vision therapy since they had not yet taken the course in strabismus and amblyopia. They were; however, currently enrolled in visual training theory.

The check list for dispensing tools was the last area of the questionnaire. The number of tools an individual owned was checked. Penlight and P.D. ruler were not tabulated. The author feels these items are not properly in the category of tools.

There were 35 students who indicated no assistance under the three main categories; military scholarship, WICHE, and G.I. bill. Of these 35, there were an average of 3.97 dispensing tools, rounded off to four. The range was 0-15. Of the 36 students who were on WICHE there was an average of 4.36 tools, rounded to four. The range was 0-15. For the nine students who responded G.I. bill now or previous there was an average of 7.0 tools and the range 0-14. Of the four students who responded to military scholarship there were an average of 15 tools with a range of 12-18. There were three students who reported more than one form of financial assistance under the three main categories.
GRAPH 1 (A)  AMERICAN OPTICAL RETINOSCOPE

- **Optics**: N = 5
  - Duration of use before you must recharge handle N = 4
    - E = EXCELLENT
    - G = GOOD
    - F = FAIR
    - P = POOR
    - VP = VERY POOR
    - Number at top of bar is percent
    - Time (Hours)

- **Durability**: N = 5
  - Brightness of light N = 5
GRAPH I (a)  PROPER RETINOSCOPE

OPTICS
N=24

DURABILITY
N=24

ABILITY TO LOCATE
ASTIGMATIC AXIS
N=24

HRIGHTNESS OF LIGHT
N=24

DURATION OF USE BEFORE YOU
MUST RECHARGE HANDLE
N=25

E = EXCELLENT
G = GOOD
F = FAIR
P = POOR
VP = VERY POOR
NUMBER AT TOP OF BAR IS PERCENT

Page 8
GRAPH I (C)  WELCH ALlyn RETINOSCOPE

OPTICS

DURABILITY

ABILITY TO LOCATE ASTIGMATIC AXIS

BRIGHTNESS OF LIGHT

DURATION OF USE BEFORE YOU MUST RECHARGE HANDLE

E= EXCELLENT
G= GOOD
F= FAIR
P= POOR
VP= VERY POOR

NUMBER AT TOP OF BAR IS PERCENT

TIME (HOURS)

Page 9
**GRAPH I (D) COPELAND RETINOSCOPE**

**OPTICS**

- **DURABILITY**
  - N = 12

- **ABILITY TO LOCATE ASTIGMATIC AXIS**
  - N = 15

- **BRIGHTNESS OF LIGHT**
  - N = 14

**DURATION OF USE BEFORE YOU MUST RECHARGE HANDLE**

- **E** = EXCELLENT
- **G** = GOOD
- **F** = FAIR
- **P** = POOR
- **VP** = VERY POOR

- NUMBER AT TOP OF BAR IS PERCENT

- **TIME (HOURS)**
  - 0-4
  - 4-8
  - 8-12
  - OVER 12

---

Page 10
GRAPH II (A)  WELCH ALLEN OPTHALMOSCOPE

DURABILITY  N=55

GUARANTEE  N=49

ABILITY TO VIEW FUNDUS  N=52

ACCESSORIES  N=50

DURATION OF USE BEFORE YOU MUST RECHARGE HANDLE  N=49

E= EXCELLENT
G= GOOD
F= FAIR
P= POOR
VP= VERY POOR
NUMBER AT TOP OF BAR IS PERCENT

TIME (HOURS)

Page 11
GRAPH II(a)  ROPPER OPTHALMOSCOPE

DURABILITY  N=24

GUARANTEES  N=22

ABILITY TO VIEW FUNDUS  N=24

ACCESSORIES  N=25

DURATION OF USE BEFORE YOU MUST RECHARGE HANDLE

E= EXCELLENT
G= GOOD
F= FAIR
P= POOR
VP= VERY POOR

NUMBER AT TOP OF BAR IS PERCENT

Page 12
GRAPH II(C) AMERICAN OPTICAL OPHTHALMOSCOPE

DURABILITY
N=6

NO. OF RESPONSES
15
10
5
0

(QUALITY)

83
17
E G F P VP

GUARANTEE
N=6

NO. OF RESPONSES
15
10
5
0

(QUALITY)

83
17
E G F P VP

ABILITY TO VIEW FUNDUS
N=6

NO. OF RESPONSES
15
10
5
0

(QUALITY)

67
55
E G F P VP

ACCESSORIES
N=5

NO. OF RESPONSES
15
10
5
0

(QUALITY)

60
40
E G F P VP

DURATION OF USE BEFORE YOU MUST RECHARGE HANDLE
N=5

E= EXCELLENT
G= GOOD
F= FAIR
P= POOR
VP= VERY POOR

NUMBER AT TOP OF BAR IS PERCENT

5

40 20 40

2-44-56-89-12 over 12 TIME (HOURS)

Page 13
TABLE 2
OTHERS N=7

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</tr>
<tr>
<td>B&amp;L.</td>
<td>2</td>
</tr>
<tr>
<td>Walman</td>
<td>1</td>
</tr>
<tr>
<td>Others</td>
<td>3</td>
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E = EXCELLENT
G = GOOD
F = FAIR
P = POOR
VP = VERY POOR

NUMBER AT TOP OF BAR IS PERCENTAGE
**Table I**

<table>
<thead>
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<td>R&amp;B</td>
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</tr>
<tr>
<td>Universal</td>
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<tr>
<td>Bernell</td>
<td>2</td>
</tr>
<tr>
<td>A.O.</td>
<td>5</td>
</tr>
<tr>
<td>O.S.</td>
<td>1</td>
</tr>
<tr>
<td>B&amp;L</td>
<td>2</td>
</tr>
<tr>
<td>Others</td>
<td>5</td>
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All were rated good or better with the exception of (one) R&B that was rated fair.

---

**Japanese Model** (c)

- N=10

<table>
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<tr>
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<tr>
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<tr>
<td>F</td>
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**Graph IV**

- TR IO FRAME S

**Graph (a)**

- Marco (N=59)

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<th>No. of Responses</th>
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<tr>
<td>E</td>
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</tr>
<tr>
<td>G</td>
<td>20</td>
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<tr>
<td>F</td>
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**Graph (b)**

- Topcon (N=18)

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<td>E</td>
<td>15</td>
</tr>
<tr>
<td>G</td>
<td>7</td>
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**Graph (c)**

- Japanese Model

<table>
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<td>E</td>
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<tr>
<td>G</td>
<td>40</td>
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<tr>
<td>F</td>
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**Definitions**

- E = Excellent
- G = Good
- F = Fair
- P = Poor
- VP = Very Poor

Number at top of bar is percent.
DISCUSSION

The Ophthalmoscope Basic Use and Accessories

The ophthalmoscope is used to make an objective determination of the health status of the eye. It is used to examine the adnexa of the eye, the lid margins, upper and lower lids, caruncles, conjunctiva, lens, vitreous, retina and other structures. It is also used to determine foveal and macula integrity.

The ophthalmoscope has plus and minus lenses to allow the practitioner to estimate the refractive state of the eye and to focus differentially thru the interior of the eye. There are also standard accessories that are used for evaluating various ocular manifestations. See below for accessories and their use.

**The Slit:** Determines levels i.e. elevation or depressions of lesions especially tumors and edematous discs.

**The Grid:** Is used to estimate the size of a lesion and is a record of progression.

**The Red Free Filter:** Is so called because it absorbs red light and is useful for viewing light alterations in blood vessels, hemorrhages, masked macular changes and the general eye ground known as the fundus.

For blood vessel observation, the areas of interest are, their course, size, crossings, pulsation and width of arterial light reflex. Also disc clarity and elevation or depression can be noted with the red free filter.

**Fixation Target:** Is used for eccentric fixation quantification and qualification. The circles are calibrated to represent a unit of displacement of c.m./meter called a prism diopter.

**Large Apperture:** Used for viewing the general eye ground known as the fundus.
The Retinoscope and Its Basic Use

The retinoscope is an instrument for determining the refractive state of the eye. It consists of a transparent or perforated mirror which serves to project light to the patient’s eye from a light source and thru which the observer views the light reflected from the patient’s eye. The observer neutralizes with and against motion with lenses in front of the patient’s eye. When neither is apparent, the refractive state has been determined. There are two types of retinoscopes, a spot and a streak and there are two mirror modes, plano and concave. The spot retinoscope reflects a beam of light from a circular source into the patient’s eye. The streak retinoscope projects a streak of light into the patient’s eye. The streak is adjustable in width and can be rotated to examine different meridians. In the concave mirror mode, light entering the subject’s eye diverges as though coming from a point in front of the mirror and results in an against motion of the emerging light reflex in farsightness and a with motion in nearsightness. The opposite is seen with a plano mirror mode.  

There are typically two kinds of retinoscopy, dynamic and static. Dynamic retinoscopy is performed while the patient fixates a near target. Static retinoscopy is performed while the patient fixates a target at infinity or with the focusing mechanism relaxed.

Trial Lens Set Use and Description

A trial lens set is any of a set of lenses used to test vision or refractive errors. Typically, a trial lens set consists of a series of loose lenses ground to a variety of powers. These lenses are biconcave, biconvex, and cylindrical and range in powers from .12 dipters up to 20 diopters or more. The cylindrical power go up to about 6 diopters, plus and minus. In addition to sphere and cylinder lens most standard trial lens sets have auxiliaries such as prisms that range from ½ prism diopter up to 20 prism diopter, also there are accessory testing devices such as red lenses, opaque lenses, slits and pinhole lenses.

Corrected curve trial lens are designed to reduce or eliminate marginal astigmatism and/or power error and lateral chromatic aberration. However, the correction for marginal astigmatism always entails set viewing angles and set viewing distance which are not throughout the entire optical viewing range. Corrected curve lenses do, nonetheless, offer a discrete advantage over standard lenses. Their advantages lie in the fact that they do correct for aberrations; their powers are additive and they are polished to a finer degree. The lenses have a tolerance of .03 diopters, and the axial thickness of each lens of a given power is uniform.
Trial Frame Use And Description

A trial frame is a type of spectacle frame having variable adjustments for pupillary distance, temple length, bridge size, etc. and constructed to allow for the easy insertion and removal of trial lenses. It is commonly used in the refraction of the eyes. In addition it is used extensively in visual training and is used frequently by some practitioners to simulate a tentative prescription.
CONCLUSIONS

For the ophthalmoscope, American Optical was rated higher (100%) excellent or good in the most important aspect, that is, ability to view the fundus. Welch Allyn was a close second with (92.5%) excellent or good. 53 Welch Allyn ophthalmoscopes were rated, compared to 6 American Optical ophthalmoscopes. Because of this number discrepancy, it would appear that Welch Allyn is the preferred scope. This could also be due to some factor that the students knew that was not brought out in this paper. Propper came in a distant third, with (41.7%) excellent to good in ability to view fundus. Costs are not too different—American Optical is $159.00, Welch Allyn is $142.00 and Propper is $120.00. It would appear that the small cost differential would be of little consideration in the choice. If quality is what you want Welch Allyn is the best buy, followed by American Optical. One Keeler and one Neitz were rated excellent in this survey.

For the retinoscope, Copeland is superior in two major features, optics and ability to locate astigmatic axis. Considering its price, it's the best buy. Welch Allyn is the second best buy, (it has a superior brightness of light), followed by Propper and American Optical, respectively.

With respect to the trial lens set, Western Optical or a similar Japanese model is the best buy. These lenses are larger and have a greater optical diameter than corrected curve lenses and therefore, are more useful in vision training. They are also less costly. For quality American Optical Tillyer Masterpiece corrected curve and Marco corrected curve are a toss up with the edge going to Marco, because of its price.

Topcon is the best trial frame in this survey with Marco and others running a close second. The Japanese model could be any named trial frame, so the term Japanese model is ambiguous.

Students who have military scholarships spend more money. This is indicative by the data showing average number of dispensing tools.

Also, students will buy all models, some will think their instrument is perfect - others will think the same instrument is a piece of junk. Shop around and secure the best buy for you!


4. IBID. PP. 1072-1076.


7. IBID.


9. IBID.


13. IBID.

14. IBID.


APPENDIX
DIAGNOSTIC EQUIPMENT EVALUATION QUESTIONNAIRE

In order to make it easier for incoming students to purchase their equipment, your assistance in filling out this questionnaire is most valuable. Please do not sign your name on the questionnaire.

Sex

☐ Male
☐ Female

Age

☐ 20 - 30
☐ 30 - 40
☐ Over 40

Professional Year

☐ 3rd Year
☐ 4th Year

Military Scholarship

☐ Yes
☐ No

MICHÉ

☐ Yes
☐ No

G.I. Bill (now or previous)

☐ Yes
☐ No

What make(s) or model(s) of ophthalmoscope do you own? If more than one, please place in the square the order of purchase instead of a check, i.e., ☐ Propper, ☐ Welch Allyn.

☐ A.O.
☐ Welch Allyn
☐ Propper
☐ Other (Specify) ________________

What make(s) or model(s) of retinoscope do you own? If more than one, please place in the square the order of purchase as above.

☐ A.O.
☐ Welch Allyn
☐ Propper
☐ Copeland
☐ Keeler
☐ Other (Specify) ________________

How did you purchase or acquire your ophthalmoscope?

☐ was given to me
☐ acquired through P.U. Bookstore
☐ acquired through group purchase
☐ acquired through self investigation and purchase
☐ other (specify) ________________

How did you purchase or acquire your retinoscope?

☐ was given to me
☐ acquired through P.U. Bookstore
☐ acquired through group purchase
☐ acquired through self investigation and purchase
☐ other (specify)
As an after thought, check the below statement which is most appropriate regarding your purchase of diagnostic instruments.

- I would purchase the same unit
- I should have done more research before I purchased
- I would like to have been less pressured by salesperson(s)
- I had no idea in advance of what I wanted and how to go about getting it
- I knew well in advance what I wanted and how to go about getting it

My final decision for selecting my particular make(s) was heavily influenced by:

- Low cost
- High cost
- A friend or upper classmate persuaded me
- The feel of the instrument
- The optical properties and accessories
- The guarantee
- Other (specify) ____________

Rate your retinoscope based on your experience with it. Indicate which is being rated 1st purchased or 2nd.

<table>
<thead>
<tr>
<th></th>
<th>Excellent</th>
<th>Good</th>
<th>Fair</th>
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<th>Very Poor</th>
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<tr>
<td>Ability to locate</td>
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<tr>
<td>Astigmatic axis</td>
<td></td>
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<tr>
<td>Brightness of light</td>
<td>2-4 hrs.</td>
<td>4-6 hrs.</td>
<td>6-8 hrs.</td>
<td>8-12 hrs.</td>
<td>Over 12 hrs.</td>
</tr>
<tr>
<td>Duration of use before you must recharge handle</td>
<td></td>
<td></td>
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</table>

Rate your ophthalmoscope based on your experience with it. Indicate which is being rated 1st purchased or 2nd purchased.

<table>
<thead>
<tr>
<th></th>
<th>Excellent</th>
<th>Good</th>
<th>Fair</th>
<th>Poor</th>
<th>Very Poor</th>
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<tbody>
<tr>
<td>Durability</td>
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<td>Guarantee</td>
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<tr>
<td>Ability to view fundus</td>
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<tr>
<td>Accessories</td>
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<tr>
<td>Duration of use before you must recharge handle</td>
<td></td>
<td></td>
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</tr>
</tbody>
</table>

Page 23
Which of the following apply to your trial lens kit?

- Plus and minus cylinders
- Minus cylinders only
- Corrected curves
- Marco
- A.O. Tillyer masterpiece
- Western Optical
- Japanese model
- Other (specify) ____________________

How did you acquire your lens kit?

- Purchased from P.U. Bookstore
- Given to me
- Purchased through independent effort
- Other (specify) ____________________

Rate your trial lens set.

- Excellent
- Good
- Fair
- Poor
- Very Poor

□ □ □ □ □

- Adequate for school only
- Good for school and private practice
- No good for school or private practice

Indicate the single most influence below which prompted you to buy your lens kit.

- Low cost
- High cost
- Wanted something only for school
- Wanted something for school and private practice
- Influenced by upper classmate
- Other (specify) ____________________

What was the approximate price of your lens set?

- Under $300.00
- $300.00-$400.00
- $400.00-$500.00
- $500.00-$600.00
- $600.00-$800.00
- Over $800.00
What make or model of trial frame do you have?
- Maroo
- A.O.
- Japanese model
- Other (specify) ____________________

What was the approximate price of your trial frame?
- Under $70.00
- $70.00-$80.00
- $80.00-$90.00
- Over $90.00

Rate your trial frame.
- Excellent
- Good
- Fair
- Poor
- Very Poor

Please check the following if you have them.
- Retinoscope
- Ophthalmoscope
- Transilluminator
- Trial lens set
- Schematic eye
- Oculder
- Clinic jacket
- Tape measure
- P.D. ruler
- Near point card, hole card
- Cross grid card
- 62 m card
- Single line card
- Fixation beads
- Pointers
- Keystone stereo cards
- Lens clock
- Trial frame
- Electronic calculator “four function”
- Amsler grid
- Measuring magnifier
- C.L. spinner
- Rubber C.L. holder
- Diagnostic set - 10 Contact Lenses
- Direct ophthalmoscope
- Red-green glasses with handle and with elastic
- Bagolini striated lenses
- Worth 4 dot test
- Polaroid glasses
- Small prism bar
- Loose prism set
Dispensing Tools

- Optical screwdriver
- Thumb file
- Large file
- Chappel end cutter
- Temple analing pliers
- Penlight
- Flat and round pliers
- Hollow snipe pliers
- Comb, fiber and chain metal nose pliers
- Vertical hinge pliers
- Gripper pliers
- Numont pliers
- Lens Axis pliers
- Lens clippers

- Lens measure
- Hex nut wrench set
- Screwdriver set
- File kit
- Hand drill holder
- China marking pencil
- PD ruler
- Misc. drills and taps

Please place completed questionnaire in Joe Upchurch's Forest Grove Clinic mail box.
### APPENDIX IIIA

| OPTICAL MICROSCOPES | Aperture | Selective Disc | Level Selection Disc | Illuminated Lens | Indicator | On-Switch & Rheostat | Red-Free Filter | Grid | Slit | Eccentric Finishing Pattern | Large Aperture | Interchangeable Retinoscopie & Optics | Halogen Bulb Disc | Auxiliary Lens | Lens Range | No. of Viewing Apertures | Binocular Head | Optional Scope | Nucleus Beam | Front Surface | Subcutaneous | Built-In Cover | Dust Cover | Voice and Handset | Price |
|---------------------|----------|----------------|---------------------|------------------|-----------|----------------------|----------------|------|----|---------------------------|---------------|-----------------------------------|----------------|----------------|-----------|------------------------|---------------|----------------|----------------|---------------|-------------|-------------|-------------|-----------|
| KLEBER 2.5X         | C        | C              | C                   | C                | C        | Q                   | C              | C    | C  | C                        | C             | C,C,A               | +29/-30       | A,C      | X         | X                     | X             | X               | X             | X             | X           | 7206        |
| PROPPER             | C        | C              | C                   | C                | C        | C                   | X              | X    | +40/-20 | C,A                     | X             | A,C                 | 17            | C,A      | X         | E                     | C             | C               | X             | $130         |
| AMERICAN OPTICAL     | C        | C              | C                   | C                | C        | C                   | C              | 0    | C  | A            | C,A            | C,A                 | 23            | Q         | X         | E                     | X             | X               | C             | $159         |
| WELCH ALYN          | C        | C              | C                   | C                | C        | C                   | C              | C    | C  | C,A                      | A,C            | X                   | 16            | Q         | X         | E                     | C             | C               | A,C           | $142         |
| FEIZ SUTHER D       | C        | C              | C                   | C                | C        | C                   | 0              | Q    | X  | E                        | X             | X                   | +37/-42       | A,C      | Q         | X                     | X             | X               | Q             | $198         |

A = Advantage  
B = No Particular Advantage  
C = Standard With The Instrument  
D = Option  
E = Disadvantage  
All Numbers are Quantitative  
X = No  
Q = Information Unavailable In Brochures Obtained

*Prices were taken from 1978 Bernal Catalogue and do not include student discount or group discount. Prices are never less quite competitive.*
<table>
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<tr>
<th>Price</th>
<th>Price (Streak)</th>
<th>Reserve Switch Power</th>
<th>20% Discount With 20 or more People</th>
<th>Handle Interchangeable With Other Models</th>
<th>Enlarged Peephole</th>
<th>Black Styling</th>
<th>One Finger Control Rotation, Streak Continues 360° Streak Rotation</th>
<th>Full Aperture Mirror</th>
<th>Forehead Rest</th>
<th>Plane to Concave Mirror Effect</th>
<th>Presbyopic Lenses +1.00 or +2.00</th>
<th>Semi-Silvered Mirror</th>
<th>Near Fixation Light</th>
<th>Return for Credit 10% Decrease</th>
<th>Warranty</th>
<th>Discount For Students at Bookstore</th>
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## APPENDIX III

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<tr>
<th>SALESPERSON</th>
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<tbody>
<tr>
<td>PEGGY HANSON</td>
<td>Pacific University Book Store</td>
<td>All Makes and Materials</td>
</tr>
<tr>
<td>TERRY SCHMIDT</td>
<td>Welch Allyn</td>
<td>Diagnostic Sets, Ophthalmoscopes, Retinoscopes, etc &amp; Asseccories</td>
</tr>
<tr>
<td>(206) 827-7735</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Kirkland, WA 98033</td>
<td></td>
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</tr>
<tr>
<td>JOE ST. LAURENT</td>
<td>Precision Optical Instrument Service, Inc.</td>
<td>Full Line of Diagnostic Instruments</td>
</tr>
<tr>
<td>(503) 223-2565</td>
<td></td>
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</tr>
<tr>
<td>Portland, OR</td>
<td></td>
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<tr>
<td>WAYNE COLE</td>
<td>Americal Optical</td>
<td>Full Line of Diagnostic Equipment</td>
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<tr>
<td>Branch Manager</td>
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<td>DON BELSHAW</td>
<td>House of Vision Instrument Co.</td>
<td>All Makes and Models of Instruments</td>
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<td>ROBERT CAUFMAN</td>
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<tr>
<td>DR. RICHARDSON</td>
<td>National Publications Optical Division</td>
<td>Japanese Imports; Trial Frames, Trial Lens, etc.</td>
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