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Visual aids for contact lens I

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Abstract
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VISUAL AIDS FOR CONTACT LENS I

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I wish to express many thanks to Dr. West, my advisor for his guidance and patience with me in completing this thesis. I would also like to express my gratitude to Mrs. Wilberta Teeter for her help in construction of the visual aids, and to Donald Garris for slide manufacture. Much appreciation also goes to Dr. Jurgen Meyer-Arendt for helpful optical concepts.

The purpose of this thesis is to provide an easier means for Contact Lens I students to conceptualize corneal-lacrimal lens-contact lens relationships. Included are such principles as apical touch, apical clearance, effects of astigmatism, eccentricity, diameter of the contact lens, lens lag, and the effects of peripheral and intermediate curves. These principles are illustrated by means of transparencies for the overhead projector along with slides and handouts. An extensive literature search was also conducted to provide information on the best methods of visual aid production and utilization.

Most teachers have had at least a limited exposure to the use of visual aids in the classroom according to a study conducted by Laird (1978). He attempted to evaluate the use of visual aids with respect to the type of material or message to be conveyed. For example, he found that math teachers prefer the overhead projector as the most effective visual aid presentation method in demonstrating concepts. In order to design such a presentation which directs the learner to the information he must acquire, Borden (1978) found that the components of the delivery system must be recognized along with the processes by which the components interact in delivering the information. Thus, one must be sure that the processes facilitate rather than block the transmission of the message. Furthermore, cognitive load must be considered with the visual aid designer's first task to restrict the information presented per exposure to that which must be acquired for functioning in later learning interactions. For maximum efficiency, the mode of presentation, identification, recall, processing, and testing must be through the same medium. Otherwise, additional time and further presentation must be allowed for processing to another format. For example, students generally respond best when orally tested on materials so presented. However, if the teacher gives a written presentation as well and sufficient time is allowed for adequate note taking by the students, they will respond equally in terms of oral and written testing. Any means by which the student gains the opportunity to interact with the presentation and obtain feedback, converting from one modality of learn-

ing to another successfully, will benefit long term memory. Thus, a presentation in which the learner visualizes, hears, illustrates on paper, and makes a written summary of a concept will be more effective than one in which he merely hears the concept being presented. Hence the value of multimedia and visual aids.

Logically, assuming that visual aids are of value to the instructor, the next question is to decide what type of visual aid will work best in a given learning situation. Winn (1977) investigated the validity of making media selection decisions based on the properties of the different media and their ability to effect learning behavior. Associated with this investigation is research concerned with the structure of learning and content. There seems to be a two way process between perception and conceptualization such that the learners' concepts affect the way he perceives the learning environment and likewise interaction with the learning environment alters the way the learner organizes his concepts. Therefore, to evaluate a particular learning environment one must compare the learner's cognitive structures both before and after the instruction. In choosing the correct media for a presentation, an attempt must be made to match environmental and content structure with cognitive structure. To do this a learners' cognitive structure must be determined by (1) identifying the concepts in memory, and (2) describing the relationship between one concept and the next. Ideally, there should be no gaps or lack of needed associations in the learner's cognitive structure. The presentation's environmental structure should determine

the ongoing organization of the learner's cognitive structure; otherwise the learner will impose his own organization on what he perceives which may not be the instructors' intent. Logic and order to concept placement including the quantification of interconcept distances may be obtained quite efficiently through the use of correct media presentations.

A study was conducted on the effective use of visual materials in lecture by Kuether (1971), specifically the correct use and production of the 2 by 2 inch slide. He found one major difficulty in the choice of visual aid material to be that the purpose of presenting visual aid material in a journal differs from that of a lecture presentation. In a journal the function of the visual is to present detailed material which would be difficult to express verbally (in sentence structure) while in lecture presentation the purpose is te emphasize, clarify, or demonstrate a trend or physical relationship. Hence, the difficulty in presenting tables of information in a lecture situation. Unfortunately, such presentations often detract rather than enhance the lecture. Each major point of the lecture should be considered in advance and where necessary a visual should be designed to enhance and illustrate it. A rough sketch of the visual along with a written verbal cue will greatly improve the lecture notes and would be of value in student handouts as well. Also, limiting the information per visual (or slide) with high density slides reserved for summaries improves comprehension.

In the proposed study, the use of color coded transparencies with each component of information a different color should achieve the same

effect. In order not to detract from the lecture, the visual should be highly visible and only shown when relevant. The actual visibility of the image is influenced by three factors (1) the size of the projected image, (2) the light output of the projector and (3) the ambient illumination in the room.

Another means of presenting each component or concept individually and then in summation involves the use of a multi-media presentation. Burke (1977) conducted a survey study on multimedia criticism and utilized Perrins theory of multi-imagery which states that "simultaneous images on a large screen or adjacent screens create a patterns of information comparison and simultaneous visual montage; these visually rich displays increase information density and facilitate certain types of learning. The types of learning most suited to multi-imagery are things such as comparisons, contrasts, details, interrelationships, and steps in a process."[1] Four areas to be evaluated in providing a multi-media program include (1) content of the program, (2) the style and structure of the program, (3) the potential value of the program for a specific audience and (4) ones' own experiental reactions to the program. Ideally, such a multi-media program will communicate a message by which the consciousness of the sender of the message is joined to that of the receiver. Loss of attention or other forms of communication breakdown occur either from external noise in the presentation environment or from internal noise during the learners encoding or decoding.

The design of the multi-media program often determines how clear and effective the message will be. Factors included are the number of

1. Burke (1977) p. 59

image areas and their arrangement, image size, appropriate length and pacing. For example, the primary concept should be illustrated through the use of a large image size with smaller images for supplementary concepts. Pacing must be fast enough to maintain attention but slow enough for adequate comprehension. Length should be sufficient to explain the primary message. Technical quality of the program must be considered so that a sharp focus and proper lighting of the pictorial subject is maintained consistently. The aesthetic quality of the program should be evaluated in terms of the proper placement of lines, colors, and shapes with the eye being directed to the most important subject matter. The environment of the presentation is another concern involving:

1. adequate sightlines to the screen
2. images large enough for the most distant viewers to discriminate detail yet small enough that the closest viewers are not overwhelmed.
3. ambient lighting sufficiently low for image clarity yet high enough for note reading and taking.

A final concern in multi-media evaluation involves the difference between the real time of the presentation and the restructured time in which the "frozen" slides and other presentations must flow, without appearing mechanical or jerky. Thus, the need for practice in presenting the program prior to the actual presentation (dry run).

Main(1977) found that pictorial supplements can change the character of a verbal information presentation by drawing attention to particular points of interest and may even emphasize structural or functinal

relationships that were buried in the verbal content. Such supplements may also motivate the student to increase his study time and thereby improve performance. Like-wise, Rai (1975) concluded in his investigation of teaching methods that the most effective method performance-wise was the field-trip discussion, the second most effective was the demonstration-discussion, and the least effective was the lecture-discussion method.

Akerman (1971) evaluated the effectiveness of cooperative projects in which one student and one professor worked together to develop media productions which were used to enhance classroom instruction. The students' primary area of responsibility was in the design and production of visual materials to aid instructional procedures while the professors' role was that of a subject matter expert. The professor made contribution to design, evaluation, and production and emphasized the content areas desired. Ten profitable outcomes of such a partnership are listed in Appendix 1 to include (1) an increased level of knowledge in course content acquired by the student (2) the acquisition of higher self confidence by the student (3) improved professor-student rapport and (4) a greater utilization of media by the professor in the classroom with increased proficiency; all desirable outcomes of this study.

A variety of techniques and methods have been developed in the area of visual aid production. Sloan and Speakman (1972) utilized eye photography as a teaching aid to increase the amount of clinical material to which the student would be exposed. Slide-tape presentations were prepared to augment the eye photography. The automatic playback unit, projector, and a library of slide-tapes were stored in a mobile unit in the "Eye Department" where the students could conveniently use them. Cyr (1977) has provided a method by which color slides can be made without a camera as long as the original picture or diagram is expendable, a condition of rare occurence in most graduate level teaching situations. Keuther (1971) discusses methods for producing photographic slides. In addition to photographic slides, information may be communicated from the teacher to the student by way of overhead transparencies. Chartpak (see Appendix **LL**) has produced a guide which indicates seven fool-proof basic steps (p. 7-11) in their manufacture. One aspect of effective overhead transparency utilization, color v.s. black and white presentations, was investigated by Richards and Macklin (1971). They found that when brief exposures were involved the recognition time for color was about four times that of black and white. Thus, the need to minimize cognitive load when using colored transparencies. When high loads of information must be processed the utilization of black and white transparencies is advisable. In this way the information is simply and easily separated and crowding phenomenon effects are avoided. However, when complex ideas must be presented and adequate luminance is provided, greater luminance being required for color than black and white presentations,

"color coding does increase conspicuousness, separates information, and facilitates understanding."[2]

Minor (1962) discusses various means of applying color to transparencies. Included are techniques for the utilization of liquid colors and color adhesive sheets. He also provides directions on applying texture to transparencies by using adhesive sheets (see Appendix II). The relative importance of minimizing the number of sheets superimposed in an overlay was illustrated with a disproportional loss in transmittance due to haze and imperfect surface contact. Furthermore, he found that color combinations that are easily confused by people having deficient color vision should be avoided in the manufacture of color-coded transparencies. This is especially true for situations where critical distinctions are color-coded. For example, reds and greens of equal brightness and pastels should not be used with a male audience. Luminance effects may be minimized by the use of single layer colors with minimal overlap. Another study on the relative value of color v.s. black and white slide-tape presentations was conducted by Farley and Grant (1976) in which memory was the dependent variable. It was found at the .05 level of significance that a greater incidence of reminescence occurred in the color than the black and white presentation condition. One interpretation of this finding was given that "long term retention is a significant function of physiological arousal during learning, with high arousal leading to better attention than low arousal."[3]

In the production of visual aids drawings must often be enlarged or reduced in size. One rule should be remembered: as a drawing is enlarged

2. Richards and Macklin (1971) p. 436
3. Farley and Grant (1976) p. 147

the quality of the image is lost but discrimination is improved. Conversely, when a drawing is reduced the detail increases but discrimination decreases. The task is to find the point of optimum detail and discrimination. Horrox (1978) listed several methods in order of decreasing resultant quality and cost as follows: photographic, photocopying, opaque projector, squaring techniques, pantograph and rubber band techniques.

When physiological changes over time must be presented, or any four dimensional system, it becomes extremely difficult to execute since concrete or fixed visual aids are by their nature two or three dimensional. One means of overcoming this dilemma is through the use of Polarmotion transparencies according to Askenaz (1977). These transparencies simulate motion when viewed through a rotary analyzer on an overhead projector. Motion can also be simulated through the use of a videograph presentation as discussed by Hawk (1978) in which a series of 35 mm slides were utilized according to cut, dissolve, zoom, pan and tilt methods. These methods were found to be too expensive for the present enterprise as far as portraying events over time. A roller-type mounting was attempted but proved to be unstable and awkward. Chartpak's techinge approach was tried as well but transmittance was adversely affected. Reference was made to several types of mounting techniques as presented by Minor (1962) for both slides and transparencies (see Appendix II). Schultz(1965) discusses several other methods including an antiquidated roll technique in which transparencies were taped together over adaptors which permitted sequential viewing.

Many problems were encountered with this method including the tendency for the transparencies to stick together, refuse to slide smoothly over each other, transparent materials were often badly smudged and torn, and the sequence of presentation had unidirectional limitations imposed. Finally, a more effective and convenient method of portraying events over time was found which involved the use of overlapping colored adhesive sheets (see transparency no. 4). This method did not create any mechanical difficulties or adversely affect transmittance.

Along with the multi-media presentation a manual may be produced to aid the instructor in the utilization of visual aids. Such a manual should be developed concurrently with the media production and the goals and objectives of the program should be specified as determined by a study conducted by Rosenberg (1979). A variety of pre and post learning activities may be suggested to the instructor as a means of positive reinforcement to student learning.

McNutty (1978) surveyed multimedia methods of productions in terms of cost effectiveness. Several ways to produced inexpensive slides including a lift-off method, a stencil mimeograph method, scratching designs on reject slides, and using write-on slides were covered.

Utilizing the background information obtained through the extensive literature search as previously discussed, the following principles of contact lens dynamics were illustrated through the use of visual aids:

Principle	Type of Visual Aid	Reference
Lacrimal Lens a. apical touch b. apical clearance c. alignment fit	Transparency no. 1 and slides no. 4 through no. 9	Girard
Astigmatic effects on the Lacrimal Lens	Transparency no. 2 and slides no. 18 through 21	Menicon
Eccentricity	Transparency no. 3	Bier and Lowther
Refractive error effects and lens movement	Transparency no. 4 and slides no. 13 through 17	Menicon
Changing the diameter of the contact lens	Transparency no. 5 and slides no. 10 through 12	Girard
Effects of intermediate and peripheral curves	Transparency no. 6	Girard

It is sincerely hoped that the information obtained in conducting this thesis on the construction and utilization of visual aids will benefit many members of the professioral staff of Pacific University for years to come and this thesis will be placed in the library for that purpose. A complete copy of the background literature is filed along with a copy of the thesis itself with Dr. West at the College of Optometry. Likewise, the visual aids themselves are to be placed in his possession.

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Appendix 1

Appendix I

Ten profitable outcomes of student-professor co-ops are: (according to Ackerman (1971) page 41)

"1. The students are able to transfer their newly acquired media skills to their own teaching areas by virtue of having applied them in the professor co-op situation.

2. The students acquire knowledge of additional course content by working closely with subject matter experts.

3. The levels of the students' self-confidence are raised as a result of working closely with professors.

4. The professors develop and/or expand their own media skills through the association with students who are learning current and innovative media techniques.

5. The professors are motivated to seek the opinions and suggestions of the students in their classes as a result of working with the co-op students on a team basis.

6. The professors' rapport with their students is enhanced because their estimates of students in general are raised through their experience with the co-op students.

7. The professors utilize media in their classrooms more frequently and with greater proficiency as a result of working in a professor co-op project.

8. The format of the professor co-op project employs the use of a systematic approach to the design of instruction.

9. The professor co-op projects serve as public relations and recruitment vehicles for the media classes because the cooperating professors recommend them as electives to non-education majors.

10. College administrators are supportive of the program by providing funds for materials and supplies after having observed the beneficial impact of simple media production on the quality of classroom instruction."

Appendix II

Seven fool-proof basic steps in creating transparencies using Chartpak Visual Materials Kits as taken from Chartpak's overhead transparency guide:

1. Rough out your idea - Make a drawing of the basic idea, either free-hand or by tracing. Check for correct positioning, centering, balance, visibility and be sure ample room is left for lettering.

2. Prepare a master- For a final master copy, retrace the drawing onto a sheet of tracing paper. Be sure to use carbon-based substances for the tracing if a Thermographic Seminar Kit is used.

3. Process the transparency film- The master is inserted face up in the copy machine with one sheet of Thermographic film on top. The rounded corner of the film must be placed in the upper right position. Preset the machine setting dial in the range of 1-4 prior to inserting the film and master.

4. Add shading films and color tints- A sheet of colored film is placed over the transparency and a section is scored slightly larger than the necessary coverage. Carefully cut through the film without cutting the backing sheet. Smooth the film as you position but do not rub with fingers, the adhesive property of the film should seek its own level and air bubbles will be avoided in this way. Excess film is then trimmed with a knife.

5. Apply Chartpak pressure sensitive tapes- effective in aiding title positioning, indentification of labels, as lines which provide definition in a diagram outline, and for the purpose of providing information (ex: a line on a graph).

6. Transfer lettering and symbols are rubbed on- transfer the letter to the film by light rubbing with a burnishing tool, ball point pen, or other hard object.

7. Overlays- Two Mylar hinges may be used to attach overlay transparencies sandwich-style. Be sure that the overlays are in proper registration with the orginal transparency.

Several types of inks and liquid colors are discussed by Minor(1962) page 64 to include:

"1. Transparent Water Color Stamp Book - dry transparent colors in leaflet form.

2. Felt Point Pen Ink - Marks on any surface. Dries in a few seconds on porous surfaces; about 30 seconds on non-porous surfaces. Available in about ten colors.

3. India Ink - A dense, black, opaque drawing and lettering ink.

4. Drawing Ink - Translucent color inks that can be applied to a transparent and opaque surfaces.

5. Direct Offset Plate Ink - For drawing and lettering directly on paper offset plates (masters).

6. Plastic Ink - Transparent and opaque ink designed for use on acetate or plastic surfaces.

7. Transparent Water Colors - Ideal for applying color to transparent and opaque surfaces. Can be applied with pen, brush, or airbrush..."