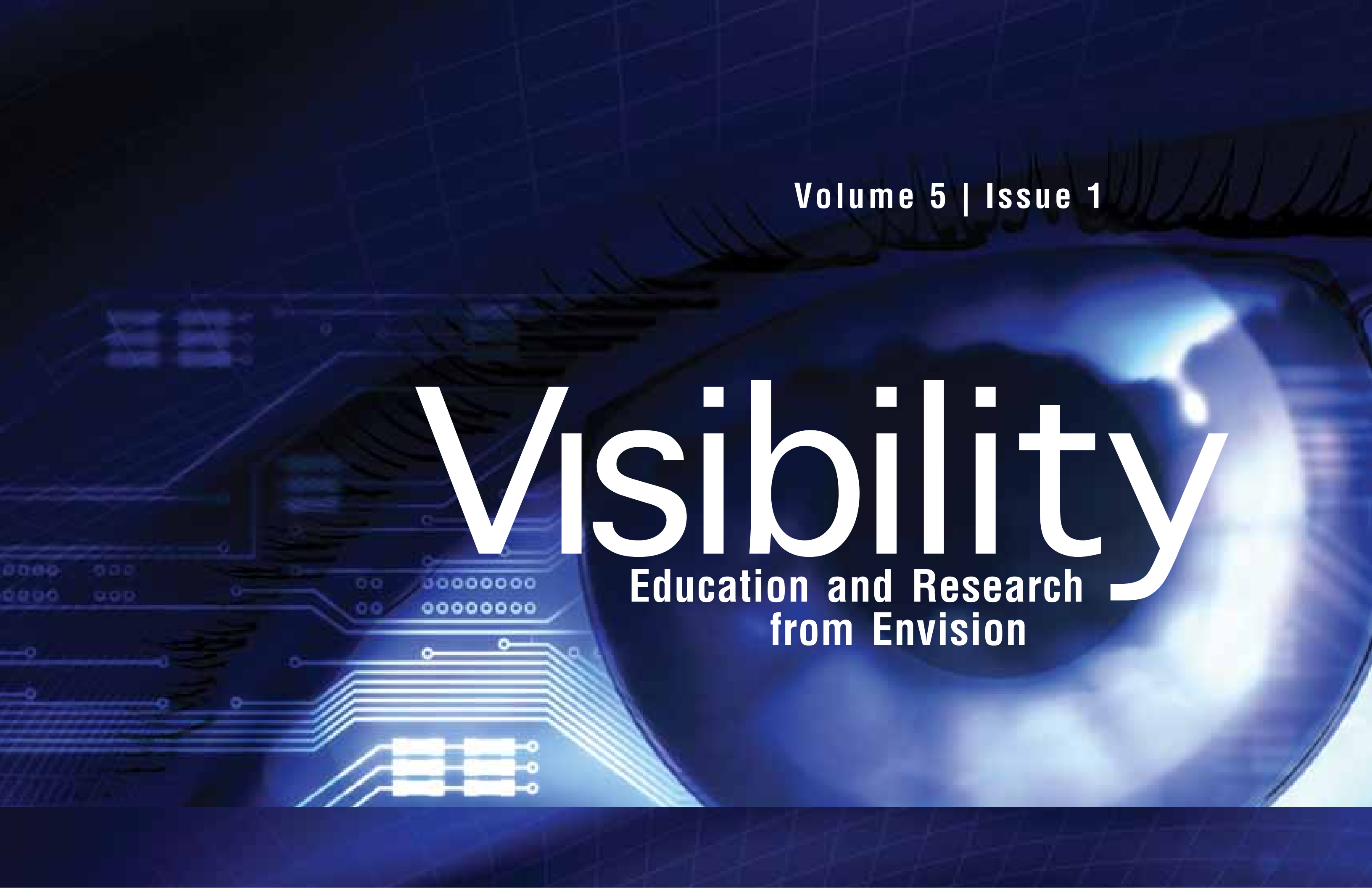
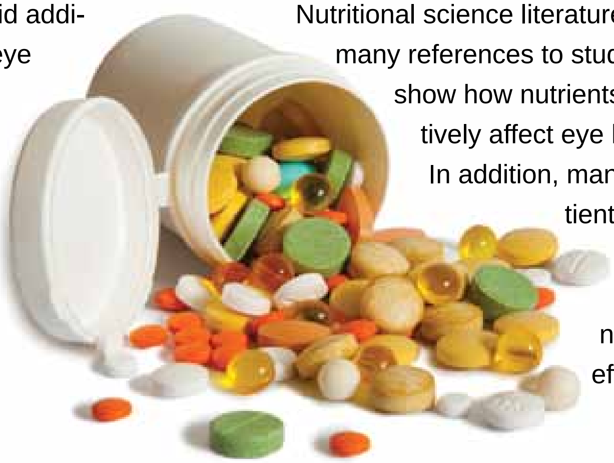


How to Choose the Right Nutritional Supplement

Jeffrey Anshel, OD, FAAO

Nutritional supplements in support of ocular health or visual disorders is a rapidly growing area of eyecare. This area can be a specialization of your practice that offers your patients the best of traditional and complementary vision care.

You must first accept that using nutrition is a valid addition to treating eye disease. While conventional medications certainly have their place, many practitioners choose to integrate nutrition which can serve to support conventional treatments. This process is called "Integrative Optometry," a practice whereby conventional and alternative therapies are both considered appropriate. This philosophy neither rejects conventional medicine nor accepts alternative therapies uncritically. Nutritional science literature has many references to studies that show how nutrients positively affect eye health. In addition, many patients prefer the use of natural, effective and less invasive interventions whenever possible. This process also shows that you are being respectful to your patients, listening to their health concerns and taking them seriously, as well as using good medical judgment.



Nutritional counseling also enhances your reputation as a primary care practitioner. According to the American Optometric Association (AOA), ODs provide more than two-thirds of the primary eyecare services in the United States. They are more widely distributed geographically than other eyecare providers and are the sole, primary eyecare providers in more than

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The mission of the Envision Foundation is to secure funding for the successful delivery of services offered by the Envision Vision Rehabilitation Center and the education programs of the Foundation. Envision Foundation focuses on fundraising to ensure that no patient is ever turned away—regardless of ability to pay; public education to help prevent blindness; and professional education to determine best practices in order to serve patients who are blind or low vision.

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How to Choose the Right Nutritional Supplement continued from front page

FDA-regulated products	Pre-market approval	Pre-market notification	Labeling	Mandatory adverse event reporting	GMPs	Facility registration	Advertising (FTC or FDA)
Foods		✖	✖		✖	✖	✖
Dietary supplements		✖	✖	✖	✖	✖	✖
Drugs	✖		✖	✖	✖	✖	✖

Figure 1. Regulation of products by the Food and Drug Administration. Printed with permission. Council for Responsible Nutrition.

4,300 communities. Optometry has made tremendous strides in the treatment of eye disease, embracing the medical model of eyecare. However, despite our best efforts, in the long run many of our patients are referred to another practitioner for a final resolution to their problem. Using nutrition as a proactive and preventive modality will allow the optometrist to maintain control of the patient for a longer period of time—maybe for their entire lifetime.

The Dietary Supplement Health and Education Act (DSHEA) was enacted in 1994 and defines a dietary supplement as "a product taken by mouth that contains a dietary ingredient that may include vitamins, minerals, herbs or other botanicals, amino acids and substances such as enzymes, organ tissues, glandular and metabolites." However, these products must have a disclaimer: "These statements have not been evaluated by the Food and Drug Administration. This product is not intended to diagnose, cure, prevent or treat any disease." This means that these products are considered foods, not drugs. But what does that say about the manufacturer's responsibility for safety and effectiveness? Yes, it's still there but does not need to be proven prior to release to the public. The chart at the top of this page illustrates the differences between pharmaceuticals, food and supplements. As you can see, the supplements are closely related to food and only differ from drugs in the pre- versus post-market approval.

There are four general misconceptions regarding vitamins and minerals for patient care:

1. ***They are completely safe.*** While this is mostly true, they can be abused and cause dangerous effects if not taken appropriately, just like any over-the-counter item.
2. ***They are ineffective.*** The effectiveness of nutrients is much more subtle and long-term than it is with drugs, but they are effective nevertheless.
3. ***They are all the same.*** Not true, especially when a multiple vitamin is considered. The type, form and amount of each nutrient can make a major difference in how it works.
4. ***More is better.*** This is the most common misconception. Just because a certain amount is effective does not mean that 10 times that amount is 10 times more effective.

To successfully evaluate patients for nutrient deficiencies, it would be helpful to assess their nutrient intake. That sounds like a daunting task and one best left for nutritionists. However, you can usually get a good sense of their basic diet by asking just a few general questions:

1. ***How many servings of fruits and vegetables do you eat on a daily basis?*** (Note: One serving is a ¼ cup or a "handful".) Also be aware that people will ALWAYS over-estimate this amount (and French fries do NOT count as a vegetable serving!). The CDC recommends 9-13 servings per day.
2. ***How many times a week do you eat fish (and what kind)?*** We now realize that smaller, fatty fish (sardines, herring, salmon, tuna, etc.) at least three times a week are the best for Omega-3 intake.
3. ***Do you eat baked goods?*** These contain simple sugars and "bad" carbohydrates; this is worse than eating "bad" cholesterol. Substituting for good carbohydrates in vegetables is a healthier alternative.
4. ***Do you take a full spectrum multiple vitamin/mineral supplement?*** While we think

continued on next page

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that eating a "balanced" diet should supply an adequate vitamin intake, it rarely happens, therefore a supplement is usually required.

5. ***Do you limit the portion of food that you eat at each meal?*** Most people eat until the plate or box is empty. Limiting portions can allow you to eat better, more nutrient-dense foods while still losing weight.

You should review products by companies who specialize in supplements for eyecare needs. Their products should have a valid scientific rationale available for anyone to review, as well as a website that puts science before price and marketing. Any company that promotes making "millions of dollars" on selling their products via multilevel means should be looked at with suspicion. Your goals should be directed toward patient health and well-being; the income will follow.

So what should you look for in a vitamin supplement to help your eyes? There are literally dozens of companies in the U.S. alone making hundreds of different products in this category. Your patients do not want to take pills all day so try to get as much nutrition as you can in just a few pills.

The first thing you should look for is a product that is a good blend and balance of nutrients formulated around the very latest science in nutritional medicine. This will take a bit of time considering the number of companies and products that are out there, and it is unlikely that you will want to learn how to be a biochemist in the process. Make sure the scientific rationale for their ingredients is available (usually on their website).

One thing to consider is the form of the pill you are taking. If your choice is a hard-pressed pill, pass on it. These hard-pressed pills have been found to not break down effectively in the body and might even pass all the way through you, still intact. A capsule or gel cap is preferable. Liquids and sprays are also an effective way for nutritional supplements to be more easily absorbed.

You may have heard the term "enteric coated" by some manufacturers. An enteric coating is a barrier applied to oral medication that controls the location in the digestive system where it is absorbed. Enteric refers to the small intestine; therefore enteric coatings prevent release of medication before it reaches the small intestine. That might have some advantages if you are taking pills on an empty stomach and don't want the stomach acids to negatively affect the action of the supplement. However, materials used for enteric coatings include fatty acids, waxes and shellac.

A full-spectrum supplement should be designed to slow the progression of chronic degenerative disease, including all diseases of the eye. There should be efficacious amounts of properly balanced fat-soluble vitamins, particularly as it relates to the latest vitamin A and vitamin D research. Vitamin A should be in the retinol form, not beta-carotene. It should contain potent amounts of the full-spectrum of B vitamins for the proper maintenance of homocysteine, specifically B6, B12 and folic acid. There should also be 400 IUs of the complete spectrum of vitamin E with a balanced mixture of both natural d-alpha tocopherol and mixed tocopherol oils containing gamma and delta tocopherols and tocotrienols.

> "Learning about nutrition can be a life-long proposition, but can be extremely beneficial to you and your patients"

Supplemental iron has been linked to heart disease, so it should be iron-free. It should also contain the full army of "job-specific" antioxidants that both prevent free-radical damage, as well as neutralize the effects of previous oxidative damage. In addition, there should be efficacious amounts of eye-specific carotenoids: lutein, pure zeaxanthin, lycopene plus properly balanced amounts of alpha- and beta-carotene to ensure proper zanthophyll transport to the retina. It should also contain the spectrum of minerals in their most bio-available form to ensure proper cellular bioelectrical and enzymatic response.

Your office protocol for approaching the patient should be done in a caring manner. First, you should diagnose the condition and carefully explain the options to the patient. Then, if you are recommending a supplement, hand the patient a brochure that fully explains the product you suggest. If they decide to purchase it right away, you should have it available to dispense as a convenience to the patient. If they want to consider it later, simply let your office staff know (via a routing slip) that you have discussed this product with the patient. They can again ask the patient if they wish to make the purchase at the initial visit or at a later time. Either way, the patient knows the supplement is available and is something that can assist in their treatment. A two-week follow-up phone call asking about the status of the nutrient recommendation can increase compliance by up to 50 percent in many cases. This also demonstrates your commitment to the welfare of your patients.

Learning about nutrition can be a life-long proposition, but can be extremely beneficial to you and your patients. While we are not biochemists or nutritionists, we should learn some of the basics of nutrition to make intelligent decisions about what to recommend to our patients. If we don't, someone else will.

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Eye Charts 101: *Stars, Sailboats and Sewing Women*

P. Kay Nottingham Chaplin, EdD

A historical review of visual acuity testing unearths some odd and interesting tales, including reports of ancient Egyptians who were required to recognize the star Sirius before they could join the hunters' fraternity,[1] an 1886 eye chart that benefited "illiterate sewing women",[2] and an 1898 chart that suggested smelling a child's ears to test hearing.[3]

A.E. Ewing, MD, of St. Louis, Missouri, designed 12 universal test characters in 1886—primarily to help investigate strabismus in young children. He discovered that his characters also helped to measure the vision of "illiterate sewing women, aphakial illiterates, and occasionally a foreigner who did not know the Roman or German letters."[2]

An 1898 letter eye chart included questions for teachers to also assess hearing. Two of the six questions on "A Visual and Aural Chart for Schools", designed by Frank Allport, MD, of Chicago, Illinois, were:

1. Does the pupil fail to hear the tick of a good-sized watch at three feet with either ear in a quiet room?
2. Does matter (pus) or a foul odor proceed from either ear?[3]

Allport's $0.25 combination chart included a "letter of warning" for parents whose children required a referral. The salutation was "Dear Sir-".[3]

Allport, F. A new combination chart for the examination of school children's eyes and ears by teachers. The American Journal of Ophthalmology. 1898;XV(8):225-30.

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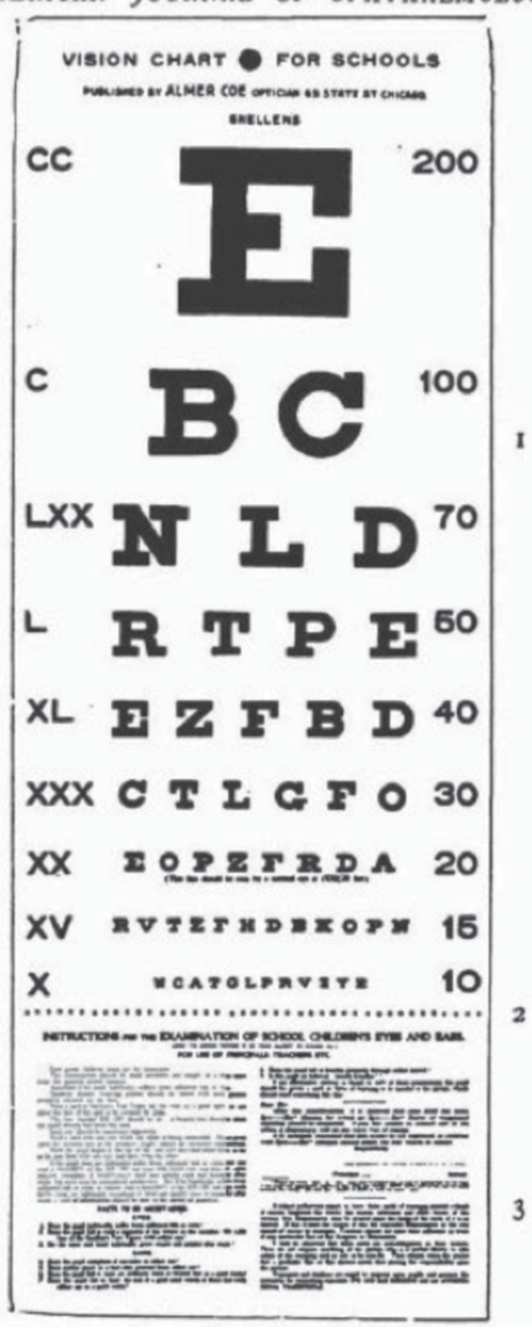


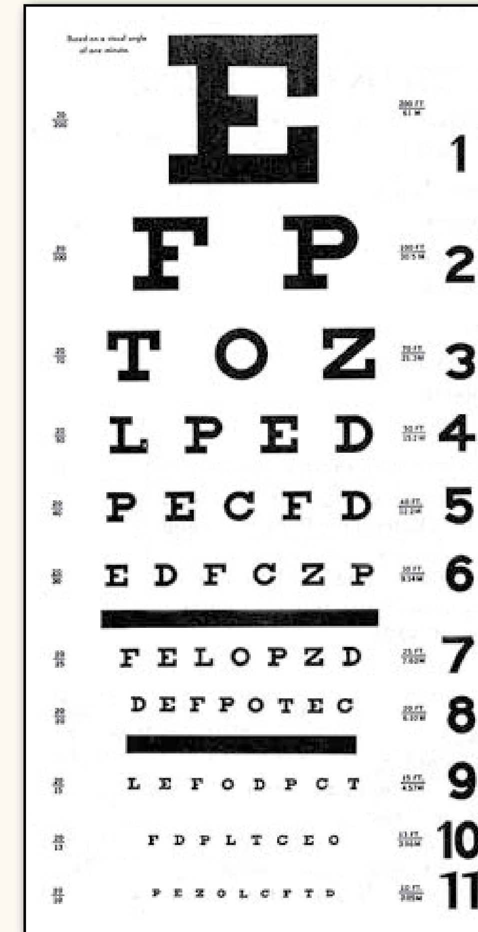
1. This section of the card should hang on the wall.
2. The two portions of the card should be separated or broken apart on this line.
3. This section of the card contains the printed instructions to teachers, and should be kept for their personal use.

Ewing's chart was predated 50 years by the work of German physician Heinrich Küchler, noted for developing the first symbol eye chart.[1,2] Küchler cut small black pictures of people, cannons, guns, birds, farm equipment, camels and frogs from almanacs and glued the figures to paper in decreasing size. He struggled with unequal picture legibility. Küchler is also cited as the first person to develop a vision testing standard,[2] suggesting, for example, that when measuring vision, one should take into account atmospheric conditions that could interfere with light intensity.[2]

Recent standardization attempts include one national guideline in 1980[4] and two international guidelines in 1984[5] and 2003.[6] Despite standardization efforts, two popular eye charts hanging in many pediatric primary care hallways fail to meet these recommendations.

Küchler's optotype legibility challenges were addressed in these recent eye chart design recommendations. The Committee on Vision of the National Academy of Sciences-National Research Council (NAS-NRC),[4] the International Council of Ophthalmology (ICO),[5] and the World Health Organization (WHO)[6] included five similar standardization recommendations:

1. Optotypes of almost equal legibility based on the Landolt C, the international reference optotype. NAS-NRC recommended the 10 Sloan letters (C, D, H, K, N, O, R, S, V and Z)[4] and WHO recommended the 10 Bailey-Lovie[7] letters (D, E, F, H, N, P, R, U, V and Z),[6] or their equivalent.
2. Equal number of optotypes per row (ICO[5] and WHO[6]) with a recommendation of five as an optimal number.
3. Horizontal between-optotype spacing equal to the width of optotypes on that row.
4. Between-row, vertical spacing equal to the height of optotypes in the next smaller row down the chart.
5. Geometric progression of optotype sizes in uniform 0.1 log unit steps between rows.



"Snellen" Eye Chart

NAS-NRC further suggested that tests used for screening should conform to the same standards.[4] Standardization permits a comparison of current examination results with previous results, a comparison of examination results conducted by different practitioners, an evaluation of treatment effects, and an evaluation of visual acuity changes over time.[4]

Though Snellen's formula of V=d/D,[8,9] where V equals the degree of acuteness of vision, d equals distance, and D equals the line on which the optotype is identified at an angle of 5 minutes,[9] has withstood the test of time; the design of "Snellen" charts meets neither national nor international eye chart design standards.

Reported "Snellen" chart challenges include:[7,10,11]

1. Variable numbers of letters per line. Some lines may contain one or two optotypes; others may contain three, four, eight or nine optotypes. Variability is problematic when testers score visual acuity based on the number of optotypes identified correctly per line. Incorrectly identifying one optotype on lines with eight or nine optotypes, for example, differs from incorrectly identifying one optotype on a line that contains three or four optotypes.
2. Unequal progression of letter sizes between lines. A loss or gain of one line has a different meaning depending on the location on the chart. Irregular and arbitrary line progression results in gaps between acuity levels, which can result in gross over- and underestimation of visual

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Eye Charts 101: Stars, Sailboats and Sewing Women continued from page 7

acuity (McGraw).

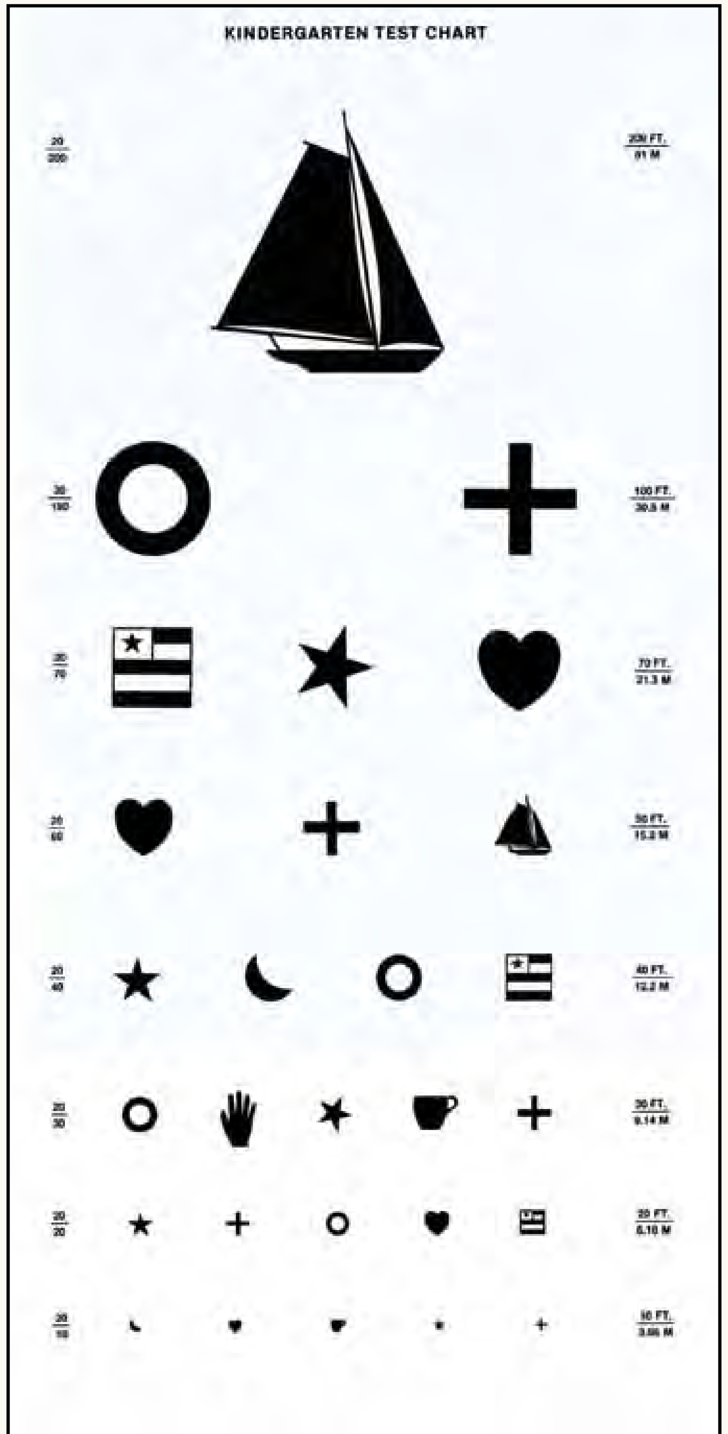
3. Unequal letter legibility. Some letters are easier to read than others.
4. Non-standardized between-letter and between-line spacing. This spacing may interfere with the "crowding phenomenon".
5. Non-standardized term for "Snellen chart". Charts may differ among manufacturers for font, letters and spacing ratios.

Many "Snellen" chart challenges also pertain to the "Sailboat" chart.

Medical literature is replete with references on evidence-based practice;[12] yet, one eye chart lacking scientific evidence remains paramount in primary care offices: the Kindergarten Test Chart (a.k.a. "Sailboat" chart), with a single sailboat optotype on the 20/200 line. This chart's history is unknown, though the earliest photograph is in an August 1935 American Optical Company catalog.

Evidence-based practice involves using scientific studies to determine best practices in a field. An American Optical Kindergarten Chart literature review returned three articles. None of the articles discussed reliability, validity, sensitivity or specificity.

The first study, reported by Fink[13] in 1944, included an American Optical Co. Kindergarten Test Chart—printed in red, blue, green and yellow[14]—among nine charts for children aged three to five. Twenty-five patients aged three and four with "at least an average degree of intelligence and co-operative attitude" required considerable explaining and training to identify optotypes binocularly at 20 feet. Fink commented that the overall size of the hand, cup and boat exceeded Snellen's five-minute angle. He also questioned the visibility of optotypes based on masses of color in the boat, heart and cup. His overall conclusion was that the chart offered no special advantages.[13]

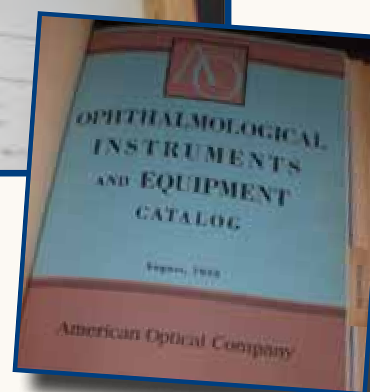


"Snellen" Sailboat Eye Chart

A second study, described by Savitz et al in 1964,[15] included three picture charts among eight types of testing materials. Ninety-four children with a median age of 39 months were screened in their homes with the American Optical Kindergarten Chart, Allen Picture Cards, and the Österberg Chart (featuring swan at top) to determine which chart they preferred. Children were asked to name at least four pictures on one test, at near distance, with both eyes open. Visual acuity was not attempted. Of the 93 children (one was excluded as an oversight), 91 (98%) preferred the Österberg Chart and two (2%) preferred the Allen Picture Cards. They were intrigued with the Allen test's booklet format. The American Optical Kindergarten Chart was "generally unappealing" and few (an unspecified number) children could identify a minimum of four of the chart's nine figures.

In a third study reported in 1969,[16] 43 of 338 children aged three through five in nine daycare centers in Austin, Texas, completed the American Optical Company picture wall chart and four additional charts. Whether the American Optical Company chart was the "Sailboat" chart is unknown. Lippmann concluded that the chart was "difficult to use … had the highest rate of untestability," and was "unsuitable for children below the age of five."[16]

Neither the "Snellen" nor the "Sailboat" charts meet national and international eye chart design guidelines. Further, the "Sailboat" chart lacks rigorous scientific evidence supporting its effectiveness. Both are oftentimes hanging in pediatric primary care office hallways.



Photos courtesy of: Dick Whitney, Global Standards Manager, Corporate R&D; and Carl Zeiss Vision, Southbridge, MA

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P. Kay Nottingham Chaplin, EdD, directed the West Virginia University Eye Institute's Vision Initiative for Children and conducted 178 preschool vision screening workshops for 1,600+ individuals, including pediatric primary care providers, between Valentine's Day 2001 and Halloween 2008. Dr. Chaplin is Director of Vision and Eye Health Initiatives at Good-Lite.

Smartphone Visual Acuity Requirements and Accessibility Options for the Visually Impaired

Kevin E. Houston, OD, FAAO, Charles J. Stumpf and Brad G. Perras, Indiana University School of Optometry

Mobile phones are an integral part of the lives of most people in Western countries. Developments in mobile technology have resulted in smartphones, defined as programmable mobile phones. Smartphones are a primary communication tool with intricate sensing capability, built-in networking and connectivity, and maximal storage capacity. Moreover, people have come to rely on their phones for the everyday management of social relationships. With their many features and capabilities, smartphones have the ability to replace many devices such as PDAs, cameras, beepers, diaries, GPS navigation, mp3 players, as well as many others. The increasing popularity of smartphones is evident by a recent estimation that approximately one billion smartphones will be shipped in 2012[1]. One of the major complaints of early smartphones was the small screen. Apple's iPhone was the first to address this with a completely virtual keyboard which used touch-screen technology to allow for a larger screen size without increasing the thickness of the phone. Since then, other manufacturers have hurried to match Apple's virtual keyboard technology, introducing similar versions such as Motorola's Droid X and HTC's EVO 4G. This trend is likely to continue in the smartphone market, as well as at public access terminals such as automated-teller machines.

At first glance, the new touch screens appear to be a great tool for the visually impaired since pinch-to-zoom magnification capabilities are standard on the majority of the models. This feature is activated with the flick of the finger. However, some visually impaired users might struggle with the loss of tactile cues from the physical buttons rendering the device unusable. Prior studies have confirmed this as a problem for blind users, but it is unknown at what level of vision impairment difficulty occurs. Manufacturers typically do not provide readily available data on the standard font size; this makes it difficult for low vision practitioners to make the appropriate calculations when prescribing magnification tools.[2]

This research intends to determine the approximate minimum visual acuity demands for today's smartphone use. This should provide low vision practitioners with some guidelines for calculating magnification requirements and tailoring prescriptions for their patients who use smartphones.

METHODS

In order to obtain a good representation of available smartphones, two phones were selected from each of the major carriers in the US: Verizon, AT&T and Sprint. Of the six models, one phone from each carrier had a touch screen and tactile keypad, while one phone only had a touch screen virtual keypad. Smartphones were selected based on recommendations from sales representatives with regard to which were most popular among consumers. The table shows a picture of each smartphone model.

Information for each smartphone was collected via online research, in-store discussion with sales representatives at corporate locations, phone interviews with national customer-service representatives, and in-store use of working models. Features considered important for the visually impaired included screen readers, voice control, magnification/zoom options, reverse contrast and adjustable font size.

We attempted to determine the Critical Acuity Demand for the essential functions of the phone which included phone calls, text messaging, navigating the web browser, reading/sending email, and locating applications on the home screen. The specifications measured were: touchscreen text messaging button optotype size; web browser address bar; text message font size; phone keypad button optotype size; and tactile button optotype size, when applicable.

All pertinent optotypes were measured in store by the same author on live phones. In order to maintain consistency, a capital "H" and the number "8" were the characters used for all measurements of font and numbered keypads respectively. All smartphones possess an auto-rotation feature which orients the screen in response to the phone's position in space. Consequently, objects on the screen change in size as they rotate from vertical to horizontal, resulting in larger buttons and optotypes when oriented horizontally. For this research, all measurements were made with the phone in the horizontal position when possible. Values were rounded to the tenth of a millimeter. Optotype height in mm was then converted to M-notation for its familiarity to low vision practitioners and usefulness in calculating predicted magnification demand. Snellen equivalent was calculated for those readers more familiar with this measurement.

To simulate levels of visual acuity loss, the authors used convex (plus-powered) lenses to blur their vision to levels ranging from 20/20 to 20/200. Authors were double blind to lens power to minimize bias. Using a reduced Snellen near card at 40cm, with a measuring string to control viewing distance, blur was introduced starting with +3.00 D lenses increasing in 0.25 diopter steps up to +6.25 D. This process was repeated one week later to ensure accuracy. With blur acuities determined, it was possible to simulate different levels of vision impairment and collect subjective data on the accessibility to the phones at various acuity levels. Again, double-blind techniques were employed; testing was repeated by both authors separated by one week; a consistent working distance was maintained using a 40 cm string; and all testing was performed under ample lighting.

The smartphone function requiring the best acuity was used to determine if there was a statistical difference between phones using a level of significance of 5% and corresponding p-value of 0.05.

	iPhone 4 c 2X mag 	Droid 2 	Droid X 	BlackBerry Torch 	HTC EVO 4G 	Samsung Epic 4G 
Text Messaging (Text Font Size)	**20/88** 4.5mm, 3.1M, 20/155	**20/26 (+/-2.5)** 2mm, 0.58M, 20/29	**20/28 (+/-2.9)** 2mm, 0.58M, 20/29	**20/30 (+/-0)** 2mm, 0.58M, 20/29	**20/33 (+/-5)** 20/60 1.2M 2.2mm	**20/26 (+/-2.5)** 2mm, 0.58M, 20/29
Web Browsing (Address Bar Font Size)	**20/80 (+/-0)** 4.5mm, 3.1M, 20/155	**20/29 (+/-2.5)** 2mm, 0.58M, 20/29	**20/25 (+/-0)** 2mm, 0.58M, 20/29	**20/24 (+/-2.5)** 2mm, 0.58M, 20/29	**20/30 (+/-0)** 2.2mm, 1.2M, 20/60	**20/26 (+/-2.5)** 2mm, 0.58M, 20/29
Home Screen	**20/80**	**20/26 (+/-2.5)**	**20/26 (+/-2.5)**	**20/21 (+/-2.5)**	**20/38 (+/-5)**	**20/40 (+/-0)**
Phone Call (Touch Screen Phone Keypad Font Size)	**20/160** 8mm, 5.5M, 20/275	**20/48 (+/-5)** 3mm, 2.1M, 20/103	**20/58 (+/-5)** 4mm, 2.8M, 20/140	**20/29 (+/-2.5)** 4mm, 2.8M, 20/140	**20/65 (+/-10)** 3mm, 2.1M, 20/103	**20/95 (+/-10)** 5.7mm, 3.9M, 20/197

Table 1: *Minimum Visual Acuity For Smartphone Use. The larger Snellen Fraction signifies the minimum vision actually needed to perform the task as determined by dioptic blur experiment. Beneath is the actual optotype size (in mm) followed by the equivalent M-notation value and Snellen equivalent for 40cm viewing distance. iPhone 4 actual minimum acuity was only determined for the address bar font. Minimum acuity for the other functions on iPhone 4 was calculated using the digital magnification capability of 2.1X.*

RESULTS

All phones had pinch-to-zoom function, though the iPhone 4, Droid 2 and Droid X had an additional magnification tool. The Droid provided the highest magnification, enlarging 2mm optotype to 31mm, M=15.5X which was applied to a small box that could be moved around over the visual display like an optical magnifier. The iPhone 4 magnifier was much more modest, enlarging a 2.2mm optotype to 4.5mm, M=2.1X, but was applied to the entire screen. We attempted to use these to perform the preselected functions of texting, web-browsing, dialing the phone, and navigating the home screen. We did not feel the Droid magnifier was realistically operational for typing functions such as text messaging and web address typing, however the

continued on next page

Smartphone Visual Acuity Requirements and Accessibility...continued from page 11

iPhone was. Minimum acuity demands for those functions were therefore measured without the Droid's mag tool.

The maximum tolerable blur for each function, as determined by the plus lens blur during live phone demo, is listed in the table. Critical acuity for the device, defined as the best acuity needed to perform ALL functions, is as follows: iPhone 4 (using the magnifier) 20/80(+/-0); Droid, 2 20/26(+/-2.5); Droid X, 20/25(+/-0), Blackberry Torch, 20/21(+/-2.5); HTC EVO, 20/30(+/-0); and Epic 4G, 20/26(+/- 2.5). iPhone, without the magnifier, was similar to the other phones, 20/25 (+/-0). Overall the Blackberry had the highest average demands for all the functions, 20/26(+/-4.24). The other phones, in order of average visual demand, were Droid 2, 20/32(+/-10.59); Droid X, 20/34(+/-15.88); Epic 4G, 20/47(+/-32.8*); EVO 4G, 20/42(+/-16.01); and iPhone, 20/102(+/-38.85).

***iPhone 4 also has an LED screen**

DISCUSSION

This study demonstrates the high visual demands required to access today's smartphone technology—despite the advantages of pinch-to-zoom technology and the more recent addition of built-in magnification tools. At this point in time, the iPhone is by far the most accessible since the mag tool is realistically usable when typing. It also has a screen reader feature called "voiceover" which is superior to others and is discussed in the following paragraph. As mentioned previously, the Droid mag tool is more powerful than the iPhone's, but is too difficult to use while typing. The small lens/window was just too hard to navigate when searching for individual buttons. The Droid's would be okay for reading a document/email/web page, but entering text would be quite difficult. The Droid magnifier did allow navigation of the home screen with lower levels of acuity, making it more accessible than the three phones which did not have built-in magnification tools. For these three other phones, even small losses of acuity, 20/21(+/-2.5) to 20/40(+/-0), rendered our authors incapable of using the home screens, thus making all functions unique to smartphones inaccessible. Acuity demands for simply dialing a phone number were low, but are of little value since traditional cell phones can perform this function at a fraction of the cost. Of the phones without enhanced magnifier tools, the EVO 4G and Epic 4G were easier to use with reduced vision than the BlackBerry. These two phones have larger-than-average displays, and larger-than-average button/optotype sizes, which likely accounts for these findings. In addition, the Epic 4G was the only phone to use an LED illumination system that enhances brightness and contrast, making it even easier to use. On the other hand, the BlackBerry Torch was consistently the most difficult smartphone for the researchers to operate. In this case, small display sizes, and the lowest resolution of the smartphones tested, were contributing factors. Furthermore, button and optotype sizes on the BlackBerry Torch were typically average or below average for all measurements, with the exception of the touch-screen keypad button size (table).

SCREEN READERS

The "voiceover" on the iPhone 4 far outperforms the other smartphones because it is the only gesture-based screen reader, allowing users to physically interact with the items on screen. The user touches the screen and voiceover gives a description of the item under the person's finger, making it possible to select the on-screen item you wish to read or identify. This is in contrast to traditional screen readers that are used in the Droid 2 and Droid X, which they termed "talkback". The disadvantage of a traditional screen reader is that it will automatically read everything on a given screen, but gives no information as to where each item is located on screen. This also makes it difficult to extract the desired information from a web page because it will read headlines, advertisements, sports scores, menu items, etc. The BlackBerry Torch, EVO 4G and Epic 4G do not include a standard screen-reader option.

"Voice control" allows the user to dial a phone number by speaking the desired contact information or digits into the phone. This feature is standard on all six of the smartphones tested. However, the iPhone 4 is the only device that also uses voice control to play music by speaking an artist's name, album or song.

RECOMMENDATIONS FOR THE PRESCRIPTION OF MAGNIFICATION

Because the pinch-to-zoom function does not work for some of the more critical functions such as typing in the web browser, email text size, and home-page navigation, low vision patients will require magnification levels that allow them to see character heights as small as 2mm, Snellen equivalent 20/29, 0.58M for all of the phones except the iPhone 4 (4.5mm, 3.1M). For continuous text, such as when text messaging, a goal acuity of 20/20 would be predicted as the critical print size, again except for iPhone where it would be 20/80. Depending on the phone, the patient may be able to have slightly poorer acuity levels, and practitioners may be able to customize the prescription based on the patient's type of phone using the table provided. Of course having the phone on hand at the exam may be the easiest way to tailor the prescription, though this could be time consuming and is not always possible. Furthermore, patients may not actually have a smartphone although accessing one might be a goal. In these cases, the table provided could be a useful reference.

CONCLUSIONS

It is important for vision specialists to be aware of all devices that could potentially assist their visually impaired patients. This can range from traditional low vision devices to new technology such as smartphones, which may have the opportunity to greatly improve independent living. Although eyecare providers may not routinely be asked to recommend smartphones for their patients, it would be prudent to educate sales representatives and patients regarding those best suited to low vision needs. Conversely, it would be equally important to inform sales representatives of which smartphones are poorly suited for the visually impaired.

The smartphone is a versatile tool that can replace many devices such as PDAs, cameras, beepers, diaries, GPS navigation, mp3 players, as well as many others. The ideal smartphone for the visually impaired patient has a large LED display with high resolution, a large font with good contrast, global magnification options, an interactive screen reader, reverse contrast, adjustable font size, and a high-quality tactile keypad. In addition, a feature by which the user can verbally dictate text messages and emails would also be advantageous.

It is worthy to note that this research is based on individuals with best corrected visual acuities of 20/20, no visual field restrictions, and normal contrast sensitivity. Using trial lenses, vision impairment was simulated so that researchers could subjectively evaluate the smartphones. An important limitation of this study is that reduced visual acuity was the only variable assessed. Future studies should be designed to include visual field loss and reduced contrast sensitivity. Furthermore, the use of visually impaired patients would legitimize proposed visual demands, from which more compelling recommendations could be made.

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This is an original manuscript and has not, at the time of submission, been submitted to another publication. The author has no financial interest in commercially available products that are substantially cited in the manuscript. All figures and tables are original.

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Envision Assistive Technology Camp 2010

Shannon Riley, MA, Research and Analytics Associate

Over the past 20 years, computer access, training and competence have become fundamental components for participation in the areas of socialization and recreation. However, computer literacy is still most important, in fact essential, in the areas of education and employment.[1-3] Providing career development training for adolescents and teenagers, including the development of computer skills, has been shown to be an effective method of minimizing the social isolation that accompanies disability[1,4,5]. Computer literacy also translates to increased independence and productivity, and maximized academic and career success, which are essential overall measures of quality of life.[1, 6]

It is with these purposes in mind that every summer since 2005, Envision invites blind and visually impaired middle- and high-school students to the Envision Assistive Technology Camp. On the recommendation of Teachers of the Visually Impaired (TVI) throughout Kansas, blind or visually impaired young persons participate in a week-long camp dedicated to establishing their independence through computer and assistive technology (AT) instruction and career development skills training. In 2010, the Envision Assistive Technology Camp took place in Wichita, May 30th through June 4th.

Each day, students attended four hours of computer skills and assistive technology training, listened to interactive leadership presentations by successful business professionals from various fields—some of whom have visual disabilities—and worked on career development skills, including résumé construction. They also honed their individual interview skills with camp culminating in one-on-one mock job interviews. Assessing the effectiveness and benefit of the computer skills and AT training is of primary importance in order to ensure that the session is: 1) fulfilling its designed purposes; and 2) continuing to improve and adapt so that the curriculum meets the needs of attendees.

PURPOSE

The purpose of this research was to assess the effectiveness of the Envision 2010 Assistive Technology Camp computer skills and assistive technology skills training.

METHOD

PARTICIPANTS

There were a total of 19 participants (15 male, four female) who participated in the camp. Participants ranged in age from 13 to 17 years old ($M = 14.94$, $SD = 1.43$). All were accepted into the program on the recommendation of the TVI in their school, and after an application had been submitted by the participant's parent or guardian. Two male participants were excluded from inclusion into the data pool due to: one participant attending the camp as a mentor as opposed to attending as a "student participant"; the other participant did not participate in the computer skills training due to being completely deaf, leaving 17 total potential participants in the data pool.

PROCEDURE

A computer skills assessment was conducted using pre/post questionnaires collected from both the participants and parents of the participants. Prior to the camp session, questionnaires were mailed and/or emailed to the parents of participants. These questionnaires consisted of 30 questions requesting information on the participant's access to a home computer, computer and internet usage habits, and competence in completing several computer-related tasks.

Pre-camp computer skills assessments were also given to participants on the first day of camp. Assessments were composed of 31 questions requesting information on self, including perceived confidence and competence in completing computer tasks and computer application knowledge.

Immediately following camp, post-test assessments were mailed to participants; these were identical to the pre-camp assessment in structure and information requested.

Post-camp questionnaires were also mailed to the parents of the participants one month after the beginning of the fall semester of the 2010 school year in order to allow adequate time for parents to observe computer use and behavior of participants following camp. These questionnaires featured the same information as the pre-camp questionnaire, but with the addition of seven questions pertaining to the perceived benefit of computer skills learned, how those skills were being used by the participant, and perceived confidence and independence of the participant in using the computer.

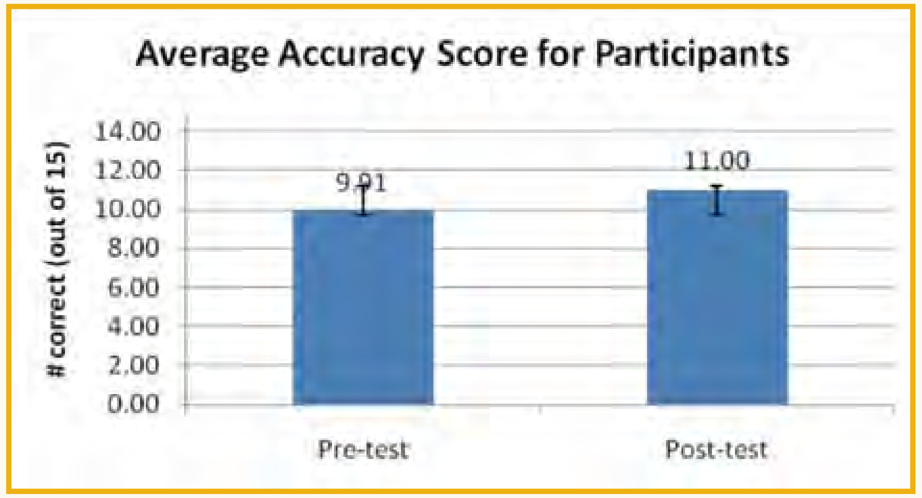

Figure 1. *Mean accuracy scores for computer application knowledge questions.*

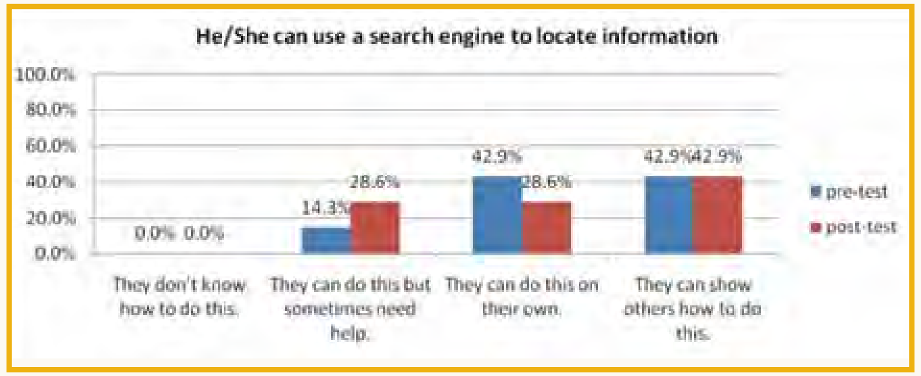

Figure 2. *Responses pre- and post-test (%) for task, "Use email to open and read a message."*

RESULTS

PARTICIPANT DATA

While all 17 pre-camp assessments were collected, only 12 post-camp surveys were returned. Analysis of the remaining 12 pre- and post-participant assessments falls into two categories: 1) accuracy of computer application knowledge; and 2) self-assessment of applied computer skills competence.

Computer Application Knowledge Questions

Both the pre- and post-camp participant surveys contained 15 multiple choice and true/false questions designed to assess the participants' knowledge of Windows operating software, such as menu commands, shortcut keys and how to carry out tasks such as renaming a file, inserting headers and footers, adding animation effects, and changing the format of an image file.

A paired-samples t-test was conducted to compare the pre- and post-camp scores for these questions. While 72.7% of participants increased their accuracy on the questions by 7.27%, the difference of the mean scores was found to be statistically non-significant ($t(10) = -.886$, $p = .397$).

Computer Skills Assessment

A self-reported computer skills assessment was conducted by asking participants to rate themselves on their ability to complete 12 tasks: using email to open and read a message; creating and sending an email; using a search engine to locate information on the internet; etc. The response set for each of the tasks included; "I don't know how to do this", "I can do this but sometimes need help", "I can do this on my own", and "I can show others how to do this." Participants reported improvement across all 12 tasks. Most tasks demonstrated a similar pattern of improvement as those provided below.

PARENT DATA

Out of the 17 participants, only 12 pre-camp questionnaires and 12 post-camp questionnaires were returned from the parents of participants, resulting in only seven complete sets of pre- and post-camp data to analyze.

continued on next page

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Computer Skills Assessment

Post-camp parent assessment indicated that while parents did notice an increase in the participants' abilities to complete the 12 tasks, they generally reported a lower degree of improvement in these tasks than did the participants themselves.

In addition to the computer skills questions, the post-camp parent survey also contained seven questions pertaining to: the perceived benefit of computer skills learned at camp; how those skills were being used by the participant; and perceived confidence and independence of the participant in using the computer. While only seven complete sets of pre- and post-camp questionnaires were returned, these seven questions can be considered in terms of all 12 post-camp parent surveys received.

- 100% of parents agree or strongly agree with the statement, "The skills learned while attending the 2010 Envision AT Camp have been beneficial to the participant."
- 82% of parents agree or strongly agree with the statement, "The participant uses the computer skills learned from attending the 2010 Envision AT Camp often."
- 67% of parents agree or strongly agree with the statement, "Since attending the 2010 Envision AT Camp, the participant spends more time using the computer for academic/school work."
- 21% of parents agree or strongly agree with the statement, "Since attending the 2010 Envision AT Camp, the participant spends more time using the computer for career exploration/job hunting."
- 67% of parents agree or strongly agree with the statement, "Since attending the 2010 Envision AT Camp, the participant spends more time using the computer for socializing, such as emailing."
- 67% of parents agree or strongly agree with the statement, "Since attending the 2010 Envision AT Camp, the participant is more confident in their computer skills."
- 83% of parents agree or strongly agree with the statement, "Since attending the 2010 Envision AT Camp, the participant is more independent in using their computer."

Figure 3. *Responses pre- and post-test (%) for task, "Create and send an email message."*

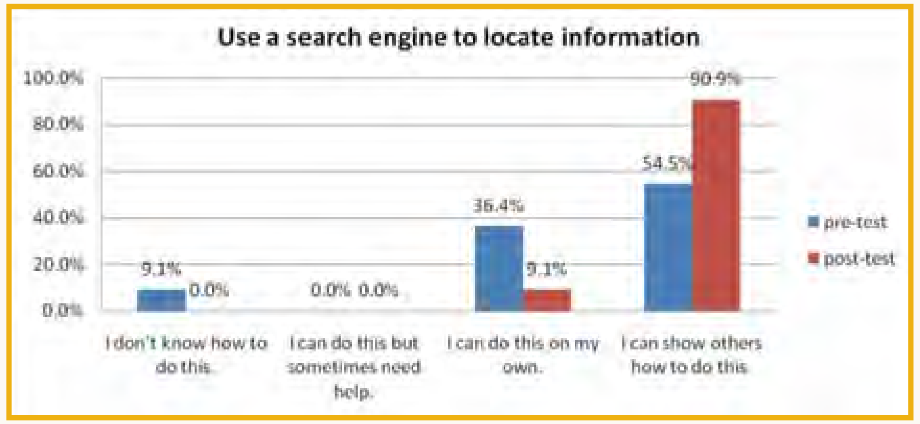

Figure 4. *Responses pre- and post-test (%) for task, "Use a search engine to locate information."*

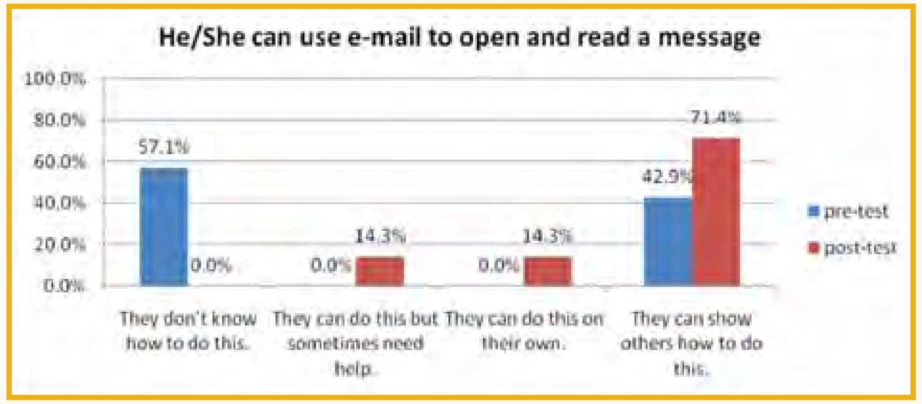

Figure 5. *Parent response pre- and post-test (%) for task, "He/She can use email to open and read a message."*

DISCUSSION

Results from this study demonstrate that the participants of the 2010 Envision Assistive Technology Camp meaningfully increased their computer skills, as reported by both participants and their parents. While it is surprising there was no significant difference in pre/post participant computer application knowledge questions, this may be explained by a combination of:

- Ambiguous/similar phrasing of provided responses. Supplied

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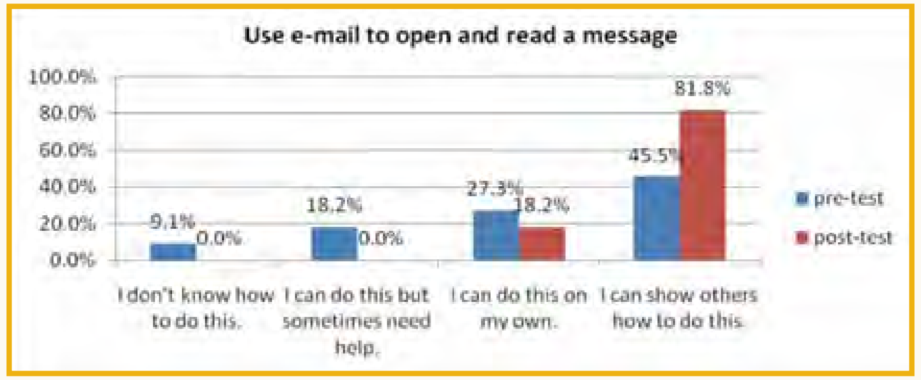

Figure 6. *Participant response pre- and post-test (%) for task, "Use email to open and read a message."*

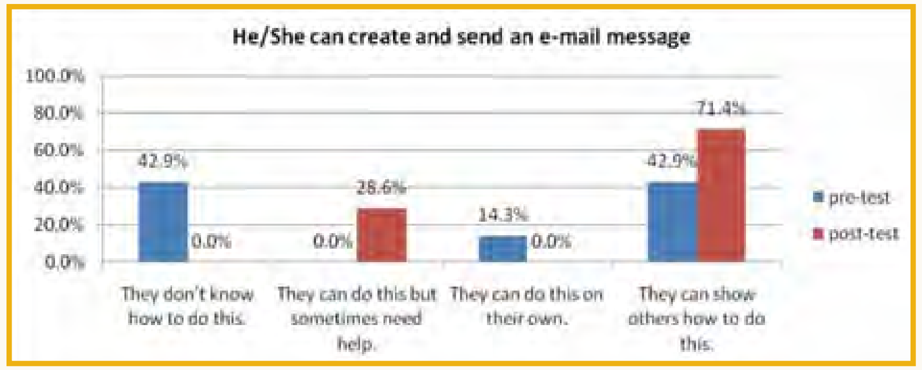

Figure 7. *Parent response pre- and post-test (%) for task, "He/She can create and send an email message."*

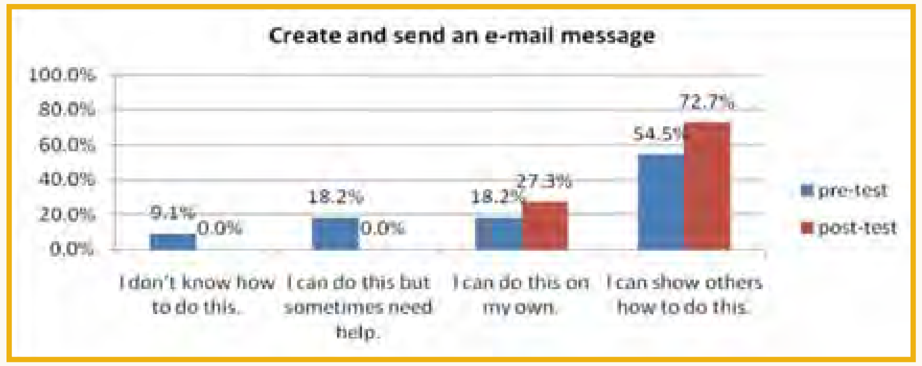

Figure 8. *Participant response pre- and post-test (%) for task, "Create and send an email message."*

Coming Attractions in Envision Research...

Rehabilitation Research

Rehabilitation Services Research- Investigation into the effectiveness of clinical rehabilitation services offered by Envision has begun with the compilation of data from the Visual Functioning Questionnaire – 25 (VFQ-25). The VFQ-25 is a brief 25-question survey designed to measure the components of self-reported, vision-targeted health status that are most important for patients that have chronic eye disease according to the National Eye Institute. The VFQ-25 has been administered prior to and following treatment to all patients of the Envision Vision Rehabilitation Center since 2005. Compilation and analysis of this data will provide Envision with an unprecedented data set on the effectiveness of Envision's rehabilitation services and treatment programs.

Driver Rehabilitation Program

Work continues on the development of the driver rehabilitation program at Envision. Currently, on-the-road driver assessments are being evaluated for reliability of measurement, which is an essential component of driver assessment.

Customer Knowledge Survey

Early in December, analysis and reporting was completed on an internal project for the Sales Department of Envision Industries. The Customer Knowledge Survey was a long-term project coordinated between the Sales Department, Human Resources and Research—the purpose of which was to assess the level of knowledge of Envision employees regarding Envision Industries' customers. The results of the study will be used to build customer knowledge into employee orientation programs.

Envision Assistive Technology Camp 2010 continued from page 17

responses to questions were similarly phrased, possibly leading to confusion and selection of an answer that would have functionally allowed them to complete the task being asked about, while not specifically being the right answer. These questions and their response sets will be evaluated in order to minimize this ambiguity.

- Amount of time having passed since the end of camp and the completion of participant post-camp questionnaire.

Parents also reported an increase in the ability of participants to complete evaluated tasks, although not of the same magnitude as that reported by camp participants. It is possible that participants overestimated their ability to complete tasks they have been taught at AT Camp, or parents may not be as knowledgeable of their adolescent's computer skills as had been assumed. Further investigation is needed.

Feedback from parents indicated that participants are consistently using skills learned at AT Camp; that those skills are beneficial to them; that participants are using those skills in a constructive manner such as for school work and social interaction; and that participants exude confidence and independence in using a computer. All indicate a positive overall effect on camp participants.

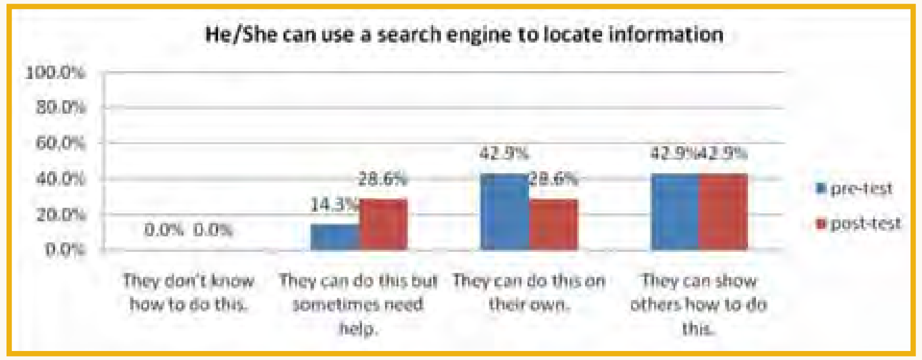

Figure 9. *Parent response pre- and post-test (%) for task, "Use a search engine to locate information."*

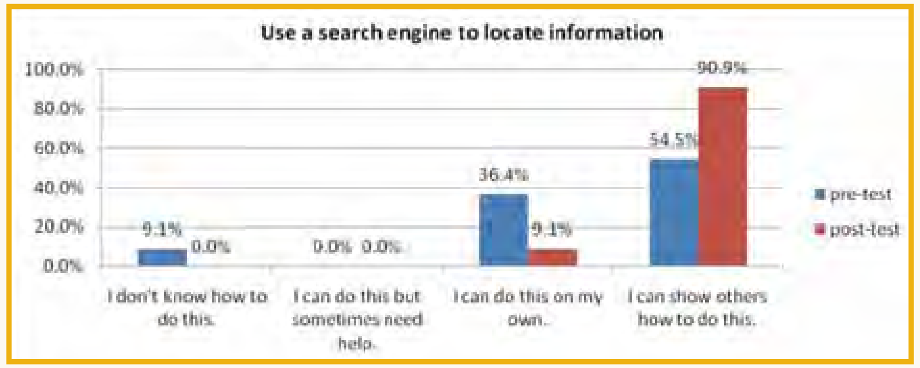

Figure 10. *Participant response pre-and post-test (%) for task, "Use a search engine to locate information."*

Areas of Improvement:

In order to increase the return rate of both parent and participant pre- and post-assessments in the future, the participant pre- and post-assessments, as well as the parent pre-assessment, will be conducted on-site during the 2011 AT Camp. In addition, the completion of all surveys, including the parent post-camp assessment, may be incentivized to ensure maximum response rate.

Overall, the beneficial effect of AT Camp has been demonstrated from the perspectives of both participants and the parents as seen in the above results. Continued refinement of assessment tools and the data gathering process will help to quantify the beneficial effects of AT Camp attendance and help shape the program to provide maximum benefit to attendees.

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Envision Conference 2011....*Meet Me in St. Louis!*

Call for Submissions and Registration Now Open for Envision Conference 2011, Sept. 21-24 at Hilton St. Louis at the Ballpark, St. Louis, Missouri

The Envision Conference is a multi-disciplinary low vision rehabilitation and research conference. Each year, hundreds of low vision professionals come together to advance standards and best practices in low vision rehabilitation. Submissions for clinical education and research presentations are welcome through March 28, 2011.

Clinical education submissions incorporate practical information that low vision practitioners and educators need in order to succeed professionally and that encourage discussion of professional concerns and views. Submissions should include concrete examples and demonstrate the unique contribution and expertise of low vision practitioners and educators and should incorporate the principles of evidence-based practice.

Research submissions are submitted as a stand-alone abstract or as part of a panel of abstracts (accepted research submissions will be presented as part of a research panel). The research submission is an early-concept, short research abstract that encompasses the exploratory stages of vision research and its potential for vision rehabilitation clinical interventions, technology applications, or surgical, pharmaceutical or gene therapy interventions. Include hypothesis, purpose or objective, research methods, results or expected results, discussion, conclusion and future directions of research and acknowledgement. Anyone who is involved in the area of visual research may submit an abstract. This includes the professional and academic visual research community, as well as applied psychology, low vision therapists, occupational therapists, orientation and mobility specialists and practicing ophthalmologists and optometrists.

"The Envision Conference was the perfect place to learn new research and techniques, network with other professionals and have a great time interacting. The individuals represented at the conference were of high standard and quality. The sessions offered covered a variety of useful topics. I can't wait to attend next year."

– Amy Elliston, 2010 Envision Conference Attendee

To submit for Envision Conference 2011, visit the "Call for Presentations" page at ***www.envisionconference.org***.

continued on next page

Envision Professional Education Calendar

Feb. 19, 2011

The Role of Occupational Therapy: Diabetes Management and Low Vision Rehabilitation. Wichita, KS. *CE - KOTA, AOTA*

April 14, 2011

Low Vision Grand Rounds - Comparison of AMD Treatment Trials (CATT): Lucentis-Avastin Trial. Wichita, KS.

CE – ACCME, AOTA, COPE

June 3, 2011

Vision Rehabilitation for Patients Affected by a Neurological Etiology And Vision Rehabilitation for Low Vision and Visually Impaired Patients. Wichita, KS. *CE – AOTA, KOTA, ACVREP*

July 14, 2011

Low Vision Grand Rounds - Early Intervention and Pediatric Vision Rehabilitation. Wichita, KS. *CE – ACCME, AOTA, COPE*

Sept. 21-24, 2011

Envision Conference 2011, St. Louis, MO.

CE - ACCME, ACVREP, AOTA, COPE, CRCC

For more information, visit the Education and Resources page at www.envisionus.com.

Erratum in: Visibility. 2010 Nov;4(4):11-15. Image size publication production errors in Figures 1-5.

Simulating Vision and the Implications of Macular Disease

Michael F. Marmor, MD, Department of Ophthalmology, Stanford University Medical Center, Stanford. David J. Marmor, MFA, Filmmaker, Pasadena, California.

Figure 1 Fundus photograph with circles showing approximate location of 5 degree and 10 degree eccentricity. 11 [IMAGE SIZE CORRECTED]; Figure 2 Page of print imaged in three different ways. TOP: Conventional photograph as we see the print in full clarity by scanning over the page. MIDDLE: Simulation with progressive peripheral blur, showing how the page appears at any one moment of fixation. BOTTOM: Same simulation with a dense central scotoma extending to 2 degree eccentricity. The eccentricities that are shown will be correct if the image is viewed 14 inches from the page. 11 [IMAGE SIZE CORRECTED]; Figure 3 View of people that are 9 feet away. The sequence of images is the same as in Fig. 2. To match the eccentricities on the image, the page must be 9 inches from the eye. 11 [IMAGE SIZE CORRECTED]; Figure 4 Street scene in San Francisco. The sequence of images is the same as for Fig. 2. The eccentricities will be correct with the image 9 inches from the eye. 11 [IMAGE SIZE CORRECTED]; Figure 5 The same views with a larger dense scotoma to 5 degree eccentricity. 11 [IMAGE SIZE CORRECTED].

Corrected and republished: http://www.envisionus.com/uploadedFiles/Media_Library/VisiblityVOL4Iss4.pdf.

Envision Conference 2011...Meet Me in St. Louis! continued from page 19

Exhibit, Sponsor, Advertise

Don't miss your opportunity for your company to exhibit at the Envision Conference. Last year the Exhibit Hall sold out in advance of the early bird deadline. Expect to see optometrists, ophthalmologists, ACVREP-certified professionals, occupational therapists, and teachers of the visually impaired. This is your opportunity to present your company's products and services to an audience of experts in the advancing field of vision rehabilitation. For exhibit rates and details, see Exhibitor Information on the conference website **www.envisionconference.org**.

> *"There is no greater resource for beginning a new or enhancing your current low vision practice. Working with all components of care involving a visually impaired patient is invaluable."*
>
> – 2010 Envision Conference Attendee

Important Dates

- **March 28, 2011** – Deadline for Clinical Education and Research Submissions
- **July 8, 2011** – Deadline for early bird Registration
- **September 21-24, 2011** – **Envision Conference 2011** at the Hilton St. Louis at the Ballpark, St. Louis, MO

*Please contact **Michael Epp**, Director, Professional Education, with questions about the Envision Conference at **(316) 440-1515 or email michael.epp@envisionus.com.***