

## Education in ophthalmology over the past 60 years

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This paper summarizes the personal experience of an ophthalmologist who has been involved in medical education for over 60 years. With clinical experience and leadership positions within ophthalmology and in broad medical organizations, this paper chronicles the evolution of educational practice and approaches for over a half-century.

**Key words:** American Academy of Ophthalmology, education, educational vocabulary, International Council of Ophthalmology, ophthalmic education, ophthalmic history, ophthalmology, personal history

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I have been invited to comment on my personal and professional observations in medical education, extending over the past 60 plus years, and I am most pleased to do so. As background, I obtained a Master's in Medical Education at the Center for Educational Development at the University of Illinois, Chicago, in 1969. I believe I am the first ophthalmologist to obtain such a degree and it shaped my ophthalmic career since that time, often in unanticipated ways.

### Preophthalmology Education

I was a product of public education through high school and obtained a BA after 3 years in a small, private liberal arts college. It was possible to enter medical school after 3 years at that time and I did so without benefit of many of the opportunities in the humanities a 4<sup>th</sup> year would have provided.

Medical school at that time (1955) was lecture based for the first 2 years, and increasingly clinical for the last two, very much along the Flexner recommendations of 45 years earlier. There were no such things as a specific curriculum, learning objectives, or formative evaluations. An example was my biochemistry course with one summative evaluation after a course lasting two-thirds of the year. We had grades, as did most schools, and there was a hierarchical ranking. At that time, 1959, it was not unusual for the graduating class to have had considerable membership loss over the expected 4 years. In my situation, of the 120 entering students, 89 graduated, including 3 from prior entering classes.

If you were uncertain of your future specialty interest (and at least 8 of my class did not go on to residency), a "rotating" internship was selected. Mine was on the West Coast in a County hospital with huge intern responsibilities, featuring

knife and gun victims, and a plethora of unusual and difficult cases. It was a spectacular opportunity, coming from a Midwest, heavily didactic, but trauma-less medical school education. The population was primarily indigent and minimally educated in contrast to my Iowa experience. The experience and capability obtained were such that I became the triage officer of an Evacuation Hospital in Vietnam, some 6 years later. There were no clear classic educational expectations, such as a curriculum, nor truly structured evaluations. I was offered an internal medicine residency, a surgical residency, and an ophthalmology residency; I selected none of the above at the Highland Alameda County Hospital, Oakland, California. I was not yet ready to leave Iowa, and the quality of education was vastly superior at Iowa.

### Ophthalmology Training

I began my ophthalmic residency in 1960 in the Department of Ophthalmology at the University of Iowa, having worked in that department for all 4 years of medical school. As at many large programs, we had "rounds" in our clinic every morning and lectures every evening. Other programs, usually smaller, had weekly rounds and relied on national (e.g. Lancaster, Stanford), regional, or combined city basic science courses. Although there were rotations through the clinical areas, distinct as they were at the time, there were few faculties who had substantial fellowship training, but all had developed specialty interests and most of all had committed themselves to a full ophthalmic practice with an emphasis. In 1960, the predominant medical

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education in specialty training, in our case ophthalmology, was more or less a preceptorship experience with lectures in various specialties along with pathology and optics lectures. At that time, pediatric ophthalmology, neuro-ophthalmology, cornea, glaucoma, and external disease were standard rotations along with surgical retina, just evolving. Refraction was learned from more senior residents. The best educational experience was from residents 1 and 2 years ahead who harassed you in a loving but focused manner. It greatly helped that there was one large clinic space where residents could share patients, and an immediate clinical observation could be widely shared and discussed. It was the most educationally impactful experience of my residency.

## The War Years

I had the pleasure of a 4-year residency, including 6-month "research" at the beginning and serving as a chief resident/junior faculty for the last 6 months. My research followed along the lines (electrophysiology, particularly electroretinography, and strabismus) that I had been employed to carry out during medical school.

As was the case at that time (1964), I had been deferred by the "Berry Plan" to finish residency. This was a federal plan to defer residents to allow completion of their residency before entry into active military duty. I was immediately sent to Fort Polk, Louisiana, where there was no equipment, hospital, or need for a well-trained ophthalmologist. Complaining rather grossly and overtly, I was transferred after 7 months to Fort Dix, New Jersey, where there was an actual hospital with instruments and patients. Being the only ophthalmologist in both sites gave me some experience in management, as chief of the service. Due to my rather challenging and obnoxious letter to the ophthalmologist in charge of assignments, I became the first American ophthalmologist in Vietnam. As a friend of mine said, "Think twice what you say and how you say it if you do not want to be sent to places you do not want to go." I was clinically active for the year, again being the only ophthalmologist as well as the Triage Officer of the Evacuation Hospital. It was the most important year of my life because I learned more about myself in reaction to change and stress than I could have otherwise. It also vastly enlarged my knowledge of the developing ("Third") world.

## Fellowship/Subspecialization

During my year in Vietnam, I contemplated the several career offers balanced between superb private offices and a return to the Iowa faculty. Knowing that I would never return to academia if I entered private practice, I chose to give academia a try. I returned to Iowa at a time when there were a number of subspecialty needs on the faculty, and I was able to play a part in a number of them plus completing and receiving an RO1 grant (NIH) on the genetics of strabismus.

It was abundantly clear, even at that time, that to advance in the academic milieu, one needed to have a distinctive skill or subspecialty. There were a number of evolving subspecialties in ophthalmology that did not interest me, including retina, pathology, glaucoma, neuroophthalmology, oncology, or immunology. While I greatly enjoyed strabismus and pediatric ophthalmology, ophthalmic plastic and reconstructive surgery, and corneal surgery, as well as, of course, cataract surgery, there

was no one thing to which I felt so dedicated or committed to apply myself essentially full time. It was at that point I began to observe the realities of all levels of medical education.

Medicine has always had a large part of its education training as a series of preceptorships. The ophthalmology faculty at that time was almost all superb and dedicated clinicians and preceptors, but there were no trained educators as such. It appeared to me that if I had a life in academia, it could and should be that of an educator. Since I knew nothing about education, *per se*, I began to review options in learning more about education. I found the premier program at that time at the Center for Educational Development at the University of Illinois under a superb educator, George Miller. He had aggregated talented teachers into an outstanding faculty, and the program took 5–8 young physician clinicians each year into a Master's program in medical education. Fortunately, I was selected. It is possible that because I had an illiterate grandfather and no one in my family had ever gone to college, that I honored and valued education more than many.

Summer school was conducted in Champagne-Urbana, Illinois. The two traditional semesters were spent in Chicago, which was 232 miles from Iowa City. I was able to get up at midnight Sunday, drive to classes Monday through Thursday noon, and return to patients and research on Friday and Saturday and family on Sunday. It seemed better than moving my family to the South Side of Chicago, where on a visit looking for housing, we observed the Democratic Convention of 1968 and its disruptive fallout, which enhanced the tranquility of Iowa City for my young family.

My eyes were opened to a new world that actually had experimental science, discipline, and philosophy about education and what people who wish to be educators could contribute. For my thesis, I elected to develop a medical school curriculum in ophthalmology. It was widely accepted and was ultimately adopted by the American Academy of Ophthalmology (AAO). An alternative idea that I explored in some depth was trying to refine the selection process of ophthalmology residents. I considered using the chalk carving test used by dental schools and a binocularity evaluations in addition to the more classic method of simple grades, letters, and the personal interview. This particular area of inquiry remains unaddressed and it would be nice to see some efforts given to study it. It seems surprising to me that a field that requires high dexterity is not routinely and prospectively tested. Yet, given the many options our specialty has, there is probably room for all.

During this fellowship, I realized that a learner would be highly facilitated by having a curriculum which contained learning objectives and clear expectations. I recognized that having both formative (while learning) and summative (at the end) evaluations were helpful to the educational process for both teacher and learner. I learned about differing types of learning and teaching methodologies which could help learners to accentuate the style through which they learn best (e.g., visual and oral). In addition, how teachers could provide a variety of teaching styles and methods. A great deal of progress has taken place in medical education since that time, and while much of my future career led me to management positions, I was always dedicated to improving the educational process in whichever organization I was participating.<sup>[1]</sup>

## Experiences in Education and Educational Leadership

I want to take special note of another individual from the University of Iowa in the AAO educational process. Melvin Rubin, a resident senior to me, evolved what became known as Ophthalmic Knowledge Assessment Program when he was at the University of Florida.<sup>[2]</sup> It was at this time that I observed the classic establishment “resistance” to change. Mel had two problems. One, the idea that a test of the evolving knowledge of a resident year to year might be useful was rejected by many of the older department chairs. Second, the very premise that questions created by others than members of the American Board of Ophthalmology (ABO) could be helpful and of high quality was challenged.

Eventually, all but one department participated, and the Ophthalmic Knowledge Assessment Program became an integral part of the assessment process in US ophthalmology. No one likes to be examined, but because it was a low-stakes examination, there was minimal resident resistance. It was used as preparation for the eventual written board examination for the ABO. It is a classic example of a formative examination.

I was honored to have the opportunity to be the first chair of the Academy’s Educational Secretariat and also was editor in the development of the first four editions of the Basic and Clinical Science Course publication.<sup>[3]</sup> These books have become the curriculum for residents, the basis for the ABO examination, and are now endorsed and used by the European Board of Ophthalmology. During my 17 years as the founding CEO of the AAO, there was a tremendous emphasis on education and new educational programs.

I became deeply involved with the International Council of Ophthalmology (ICO), serving as secretary-general and president over a 20-year period. During a fact-finding trip in one large Sub-Saharan African country in 2004, we found pure preceptorship education with no curriculum; unclear standards with inadequate examinations; very few subspecialists and no local subspecialty training; inadequate teachers and teaching; no real leadership teaching; and few strong leaders. In response to this and with the help of many dedicated educators, we were able to create an international curricula for residents in 16 segments ([http://www.icoph.org/refocusing\\_education/curricula.html#ICO%20Residency%20Curriculum](http://www.icoph.org/refocusing_education/curricula.html#ICO%20Residency%20Curriculum)); eight subspecialty fellowship-level curricula; provide over 1,000 individual fellowships from developing countries; create examinations at 4 levels and have had over 53,000 individuals examined; and created a 9-segment teaching the teachers program, including, to date, 44 program directors’ courses around the world. We are also beginning a leadership program.<sup>[4]</sup>

Another little known but significant educational event in which I participated was in 1980 when I chaired the Coordinating Council on Medical Education. This group was comprised of representatives of the American Medical Association, Council of Medical Specialty Societies, American Board of Medical Specialties, and American Hospital Association. Coordinating Council on Medical Education revised the existing educational structure in American medicine. We created the Accreditation Council of Graduate Medical Education and Accreditation Council of Continuing

Medical Education. The Accreditation Council of Graduate Medical Education is responsible for accrediting all residency programs, and the Accreditation Council of Continuing Medical Education is responsible for accrediting all continuing education programs. All of these have played important roles in the educational process of residents and practitioners to this day. I had the distinct honor of being the only person to serve as a president of both the American Board of Medical Specialties, which coordinates the interaction and planning with the member boards, including the ABO, for Certification and Maintenance of Certification, and the Council of Medical Specialty Societies which performs a similar function for the major specialty societies including the AAO.

From 1974 until 1982, I served as a member of the ABO, during which time we began to revise the written and oral examinations. A great deal has happened since using ophthalmic and other educators and evaluators to improve the certification process in ophthalmology substantially. A particular event stands out as the concept “recertification” was discussed at the time of the first independent meeting of the not-yet legally formed AAO in 1978. Recertification was driven by the fact that medical knowledge continues to expand exponentially and there is a drop-off of retention over time. I was in a position which would not be acceptable today as CEO of the AAO and a member of the ABO simultaneously. In 1979, at the first independent meeting of the developing AAO in Kansas City, there was a presentation in the large auditorium, well attended with some of us on the stage, representing the ABO and its plans. There was nearly a revolt, and fortunately, those on the stage, including myself, were not tarred or feathered while the highly negative sentiments of quite a few were hurled down to us. At the end of the session, all were alive, but few of the ABO felt well. It was a long time before the concept of Maintenance of Certification was reintroduced by the American Board of Medical Specialties members including the ABO and supported by the AAO.

## American Academy of Ophthalmology Otolaryngology to American Academy of Ophthalmology

When the original Western Ophthalmological and Otolaryngological Society was founded in 1896, most practitioners did both aspects of what is now two specialties. Later, an individual tended to emphasize eye or ear, nose, and throat in their practice. As Western Ophthalmological and Otolaryngological Society became the AAO and Otolaryngology (AAOO) in 1903, each specialty was small in numbers and met conjointly until 1978.

Education was one of the real precipitating factors that created the separation of ophthalmology and otolaryngology into separate academies. The annual meeting of the AAOO was held for many decades at the Palmer House in Chicago, which had limited space available. As the membership of each society grew, there was not space to accommodate all of the evolving educational programs as well as exhibits. Although ophthalmologists made up two-thirds of the combined membership of the AAOO at the time of the split, time for programs had for a long time been divided in half for each specialty. One year the plenary sessions for ophthalmology would be in the morning, and the next year in the afternoon,

and vice versa for the instruction courses, which were introduced by the AAOO in the 1920s and copied by many other specialties. There were also a number of other underlining currents which contributed, but clearly, the annual meeting space crunch was a precipitating stimulus for separation.

## Comments on Progress in Ophthalmic Education

The advances in medical education since 1970 are protean and continuing. My comments cannot address all aspects of the educational process, but I will comment in several general areas.

### Subspecialization

During my residency, there was a major move by NIH to support residents in their commitment toward research. This additional support for the emphasis on research careers inexorably drove the movement to subspecialization. In the era of 1950–1960s, formal subspecialization was a move mainly for those going into academic medicine. The fellowships tended to be no more than 1 year, and many informal fellowships were of 3–6-month duration. Contrast this to today, when at least 70% of residency graduates take some form of specialized training, often of 2 years duration, after the conclusion of their residency. This, of course, has many ramifications. As specialization evolved in the early part of the last century, people's loyalties moved from the general brand of doctor under the overall American Medical Association umbrella to primary loyalty to their specialty, for example, ophthalmology, and more recently, to a subspecialty, for example, retina, glaucoma, pediatrics, and so forth. The trend away from the comprehensive ophthalmologists is not unlike the trend away from the primary care physician, both of which are in short supply today and highly needed in many regions in the world, as suggested by the Commission on the Education of Health Professionals for the 21<sup>st</sup> century.<sup>[5]</sup> Due to the trend to practices being large with a full complement of subspecialists, the opportunities continue. Whether this trend will grow or level off remains to be seen. There is no doubt that sub- and sub-sub-specialization have advanced the science and clinical breakthroughs in each portion of medicine. The complexity and confusion for patients are an unintended consequence.

### Education, service, and payment in training

During my internship with a wife and 1 child, my salary was \$115 per month. After payment of rent of \$87.50, we could choose to have a telephone or eat out once or twice and still have to borrow money. During residency, the salary improved, but it was still not adequate for independent living. This has changed substantially today with a near-living wage, although payment during fellowship is variable.

The controversy regarding duty hours, as well as the impact of changing from a long stay to high-intensity admissions for a short period, has stressed the educational experience for many inpatient specialties. As ophthalmology rather abruptly moved to an outpatient specialty when cataract surgery became outpatient, the stature of ophthalmology for hospital or university administrators was markedly reduced, as ophthalmology did not add to their bottom line. When I became chairman of the Department at California Pacific Medical Center in 1971 in San Francisco, ophthalmology counted for

25% of the inpatient volume, which became nearly zero a decade later as cataract surgery become outpatient.

The tension between education and service underscores the financial dimension of Graduate Medical Education. Funding of Graduate Medical Education is and has been an issue rife with the discussion but little change as of yet. Graduate Medical Education is still being based on federal support and more linked to inpatient than outpatient care, something not in keeping with today's reality. The concept of the medical home, family-centered care, the Affordable Care Act, and the requirements for electronic health records are creating challenges in every specialty and in every payment methodology. The years ahead are almost certain to see a restructuring of the payment mechanisms to support graduate medical education as well as physician service.<sup>[6-8]</sup>

### Personalization of the educational process

We used to think of curriculum as an outline of what should be taught. The more modern understanding of curriculum concerns not only what to teach but also who to teach, when to teach, how to teach, and why to teach as well as assessment of learning.

Numerous modifications in the teaching/learning process have been introduced in medical school, residency, and much less so continuing medical education. E-learning is now a given, and the multiple individual lectures given in every school, department, or CME course are available online with generally better presentation and education approach than those previously given at a very local level. Soon, the basics will be provided as e-learning. We are aware of the differences in learning and expectations in various generations from the silent generation born 1925–1942, the baby boomers from 1943 to 1960, Gen X from 1961 to 1981, the Millennials from 1982 to 2002, and thereafter with Gen Y or Z following. Each has differing expectations in learning and working.

In addition, evolving health-care practices have elicited the need for educational change. "We have seen a rapid pace of change in healthcare, and there is a parallel revolution in medical education where integrated teaching, problem-based learning, community-based learning, core curricula, and systemic curriculum planning have been advocated. Related to these educational changes, the role of the medical teacher is many: mentor, learning facilitator, on-the-job role model, teaching role model, lecturer, clinical/practical teacher, resource material creator, study guide producer, course organizer, curriculum planner, curriculum evaluator, and student assessor."<sup>[9]</sup>

### Educational vocabulary

A partial lexicon of newer educational concepts, many not well known to physicians generally, is outlined in the following. These and others have a major role in modern education and are being used by true educators [Table 1].<sup>[10,11]</sup>

Increased interest in educational outcomes has led to new assessment tools designed to teach and assess simultaneously. A number of observational evaluations have been developed, and one of the most useful is the ophthalmic clinical evaluation exercise.<sup>[13]</sup> The specified tool is completed by a teaching physician as they observe the resident performing a patient history, examination, and then listens to the case

**Table 1: Educational vocabulary**

Educational terminology	Brief description
Andragogy (adult learning) versus pedagogy (child learning)	Andragogy includes need to know why, two-way learning, learner active (self-reflect), structure predefined, interactive format, personalized (individual), application of skills versus pedagogy: which is one-way, passive, lecture, etc.
Learning portfolios	A chronicle of the individual's learning that provides milestones, highlights best work, and provides a permanent record, including accomplishment requirements
Physician competencies	The six competencies outlined by the ACGME now incorporated in residency learning and in continuing medical education: patient care, medical knowledge, practice-based learning and improvement, interpersonal and communication skills, professionalism, system-based practice
Evidence-based education	Content that is based on actual evaluated findings rather than teachers' impressions and biases
Teaching strategies	Based on what needs to be learned and what learning style the learner prefers
Summative versus formative Feedback (examinations)	Summative: An assessment at the end, which is high stakes, judgmental, too late to improve. Formative: Given during the educational process and allows improvement and is low stakes, and usually nonjudgmental
Needs assessment	Achieve understanding of the "why," establishes gap between current and ideal performance (the "what")
Knowledge pyramid	Knowing "that" (rote memory), knowing "how" (performance based), knowing "why" (understanding rationale), knowing "when" (application in real world), knowing they know and can do it (infers competence)
Learning models	Learning in stages (Dreyfus model), learning requires practice (Ericsson model), learning requires reflection (Schon model)
Critical thinking (thinking about analyzing)	Analysis of our own ability to judge objectively the credibility and integrity of new information, reflective and reasonable thinking that is focused on deciding what to believe or do
Meta-cognition (thinking about thinking)	Analysis of one's cognitive process in such areas as study skills, memory capabilities, and ability to monitor learning
Transformational education	Goes beyond informative and formative education, to develop leadership attributes and produce enlightened leaders
Outcome-based education	Requires clear, explicit expected learning outcomes, at the end of training and at the end of each phase; content, teaching strategies and assessment should be based on agreed learning outcomes
Workplace-based assessment	Assessment of what doctors actually do in the workplace; examples: OCEX, OSCARs, 360° evaluations, case discussions
"Pimping"	A line of questioning meant to affirm the hierarchical order of a small group of learners by cultivating feelings of humiliation, fear, and intimidation for those answering the questions <sup>121</sup>

presentation.<sup>1141</sup> The teaching physician completes a scoring in 33 categories.

Another very useful surgical evaluation document is the ICO-ophthalmology surgical competency assessment rubric. Developed by Golnik *et al.*,<sup>1141</sup> it now has a specific evaluation for cataracts, strabismus, etc., The ICO-ophthalmology surgical competency assessment rubric is internationally applicable, decreases subjectivity of an assessment, and clearly communicates to the learner what is expected. Other tools are being developed by the ICO to assess important competencies of professionalism and communication skills.

## Ad Hoc Comments

I have had the opportunity to chair many committees, planning sessions, and so forth. There have been many jokes about committees and their reports, yet if properly charged and chaired (clarity of expectation and leadership), the ideas, concepts, and consensus that can come out of an effective committee, often exceeds what an individual or small group might accomplish. Many committees deserve the derision they receive, but effective committees are invaluable in moving ideas or activities forward.

As the increasing availability and utilization of the basic and clinical science course of the AAO and its Ophthalmic News and Education Network and a myriad of e-learning courses and other educational resources available on the Internet, there has been a diminution of need for regional in-person courses such as the Lancaster and the Stanford course. A new contribution by the ICO for teachers is the Center for Ophthalmic Educators ([www.educators.icoph.org](http://www.educators.icoph.org)).

The Association of University Professors in Ophthalmology has recently celebrated its 50<sup>th</sup> anniversary. The effectiveness of the Association of University Professors in Ophthalmology in early years was a forum for discussion but little action. More recently, as the program directors have become an integral part of the activities and the annual meeting, there has been a substantial emphasis on improving the educational process throughout the United States.

As the incorporation of simulation in training becomes more ubiquitous, confidence and capability in surgical and diagnostic techniques will produce more prepared trainees.

Women in Ophthalmology, an organization whose founding I supported and of which I am a charter member,

have coalesced the communication and visibility of women ophthalmologists. As ophthalmology becomes nearly 50% female, it will be interesting to see in which direction the organization evolves.

## Conclusion

Just as ophthalmic science and all the physical sciences have dramatically evolved over the past 50 years, so has the science of education. As ophthalmology developed a language of its own, uncommon, and unused by the rest of medicine, there is a vocabulary, a structure, and a science relating to education and medical education. I believe just as the science of nanotechnology is unfamiliar to most of ophthalmology, so it is with education. That does not diminish its potential and power.

I have a personal goal that I hope gains acceptance, support, and credibility: to have education recognized as one of the ophthalmic subspecialties. Historically, medicine has lagged the clergy and law in its basic preparation. Since the Flexner Report in 1911, medicine began a movement toward true professional education. Ophthalmology led in establishing the first certifying board in 1916 and by introducing annual educational courses in the 1920s (AAOO). Since that time, ophthalmology has been at the forefront of residency, fellowship, and continuing education in medicine. Recognition of a subspecialty in ophthalmic education would be instrumental in our leading the way in the future. There is at least one educator in any strong ophthalmic department. There are probably more ophthalmic educators than there are in several of our recognized ophthalmic subspecialties. This new subspecialty of education would elevate a needed and undervalued capability!

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