

Fostering Early Preclinical Experiences for Developing Knowledge, Skills, and Confidence in Key Residency Competencies Through Participation in a Medical Student Research Training Program

Journal of Medical Education and
Curricular Development
Volume 8: 1–5
© The Author(s) 2021
Article reuse guidelines:
sagepub.com/journals-permissions
DOI: 10.1177/23821205211054965



Kara E Sawarynski¹ , Stephanie M Swanberg² , Victoria A Roach³ , Tracey AH Taylor¹ and Dwayne M. Baxa¹

¹Oakland University William Beaumont School of Medicine, Rochester, MI, USA. ²Michigan School of Psychology, Farmington Hills, MI, USA. ³University of Washington, Seattle, WA, USA.

ABSTRACT: Periods of academic transition are challenging and require medical students to adjust to new environments and expectations. Commonly cited areas of struggle include integrating into the interprofessional health care team, communication, organization and time management, and self-regulated learning. Consciously designing opportunities early in the preclinical curriculum to help students gradually build these competencies can be achieved within existing research training programs or projects. This perspective article reflects on how the medical student research training program at the Oakland University William Beaumont School of Medicine supports student growth in these areas beginning in the first year, so that students can directly apply these skills as they progress to the clinical years and beyond.

KEYWORDS: “education, medical, undergraduate”[mesh], “competency-based education”[mesh], “research”[mesh], “curriculum”[mesh], “interdisciplinary communication”[mesh]

RECEIVED: July 1, 2021. **ACCEPTED:** September 29, 2021.

TYPE: Perspective

FUNDING: The author(s) received no financial support for the research, authorship, and/or publication of this article.

DECLARATION OF CONFLICTING INTERESTS: The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

CORRESPONDING AUTHOR: Kara E. Sawarynski, Oakland University William Beaumont School of Medicine, 586 Pioneer Drive, 473 O'Dowd Hall, Rochester, MI 48309, USA. Email: sawaryns@oakland.edu

Introduction

The educational journey of a medical student is marked by 2 major transition periods: from the preclinical to clinical years and from undergraduate medical education (UME) to graduate medical education (GME). Competency-based educational frameworks, such as the Physician Competency Reference Set and the Core Entrustable Professional Activities (EPAs) for Entering Residency, have attempted to map and identify the core knowledge and skills needed by medical students to be successful upon graduation.^{1–3} The EPA framework and associated toolkit provide a comprehensive overview of behaviors and skills that medical students should ideally master prior to entering residency. The 13 EPAs include areas such as differential diagnosis via engaging and communicating with team members, providing an oral presentation of a clinical encounter, forming clinical questions based on evidence, collaborating with interprofessional teams, and identifying system failures while contributing to patient safety and improvement.¹ Although widely accepted, implementing competency-based education and evaluating its universal utility in practice remains a challenge.^{4–6} Specifically, previous studies have described such difficulties as administrative issues related to implementation, assessment of all competencies, the need for faculty development, longitudinal tracking of student outcomes, and competencies not adequately addressing the care of diverse populations.^{5,6} It is also well-documented that many students and residents were self-report and demonstrate a lack of

knowledge, skills, and confidence in their clinical knowledge and performance when transitioning to the next stage of their education.^{7–9} Recurrent areas of struggle include teamwork and acculturating to an interprofessional team environment, communication, self-directed and self-regulated learning, organization and time management, preventing medical errors and promoting safety, and medical knowledge.^{7–14} Student-reported challenges are further corroborated by similar data from medical school faculty and residency program directors.^{10,13–18} What if UME programs looked beyond traditional mechanisms of teaching these competencies and integrated them earlier in the curriculum to gradually build students' skills in these areas? Many medical school curricula currently include required or voluntary research projects, offer scholarly concentration programs, and/or integrate research training across the curriculum.^{19–21} This perspective article postulates that required medical student research programs can be consciously designed to promote early preclinical skill development in communication, research design, project operationalization, and time management that directly applies to clinical skill acquisition throughout the education continuum.²²

According to a recent joint report from 4 medical education organizations on managing the transition during the time of COVID, skills related to evidence-based practice are included as being of importance in the transition from UME to GME.²³ Clearly, the opportunities offered by the conduct of research encompass the self-directed learning skills of: (1)



Creative Commons Non Commercial CC BY-NC: This article is distributed under the terms of the Creative Commons Attribution-NonCommercial 4.0

License (<https://creativecommons.org/licenses/by-nc/4.0/>) which permits non-commercial use, reproduction and distribution of the work without further permission provided the original work is attributed as specified on the SAGE and Open Access page (<https://us.sagepub.com/en-us/nam/open-access-at-sage>).

identifying, analyzing, and synthesizing information relevant to anticipated need; (2) assessing the credibility of that information; (3) sharing that information with peers and study participants; and (4) receiving and incorporating feedback on the shared information by reviewers, are present. That these same items are the essence of the Liaison Committee on Medical Education Element 6.3 regarding skills for medical student lifelong learning and that the Accreditation Council for GME also recognizes the requirement of evidence-based decision making and lifelong learning practices emphasize the importance of these skills.^{24–26}

Although these self-directed learning skills contribute to the progression of clinical training, they are by no means the only skills that would promote successful career training transition. Communication skills of physicians as applied to their patients and others in the health field community are also considered essential components of training that will lead to advances in health care and better health outcomes.²⁷ Knowing one's audience is paramount to effective communication and requires understanding their perspectives. The process of communication additionally requires interpretation in understanding any barriers that would prevent the message from being heard and understood so that credibility can be established.^{28,29} Communicating research provides just these practice opportunities.

Lastly, the conduct of a research project in UME offers practice in time management by setting goals, planning and organizing activities, and prioritizing those activities with competing responsibilities.³⁰ Effective practice in this area can lead to improved physician well-being and satisfaction as increased productivity and reduced burnout will result. It is well established that physician burnout can evolve from negative behaviors learned early in medical training.³¹

These skills of communication, research design, project operationalization, and time management are important to the transition from undergraduate medical training to graduate medical training is evident by the inclusion of survey questions included in the Association of American Medical Colleges's All Schools Summary Report for 2018 that ask students to report their perceptions of self-efficacy in the areas of communication with patients and health professionals, application of evidence-based information, and teamwork.³² Although the Oakland University William Beaumont School of Medicine (OUWB) medical student research training program (Embark) was not designed intentionally to develop student competencies in the areas described above, the program has evolved to expose students to multiple aspects of research skill development, beyond basic experimental design principles, early in their training.

Embark—Medical Student Research Training Program Description

The OUWB Embark Program is described in detail by Sawarynski et al (2019), who summarize the overall purpose,

structure, and outcomes of the program.²² In brief, Embark consists of faculty-mentored, longitudinal, independent student research projects, supplemented by concurrent research training via a series of courses spanning the entire 4-year medical school curriculum (Figure 1).^{22,33} Courses encourage the development of self-directed learning skills and professional practices in areas where research hurdles frequently exist. In particular, skills pertinent to communication, research design, project operationalization, and time management are emphasized.^{21,22,33} Students pursue projects in basic science, clinical/translational science, health systems, medical education, and community-based participatory research and frequently work within multidisciplinary research teams and research collaborators throughout the program. Data collected for these studies occur in part by surveys, interviews, focus groups, chart reviews, educational interventions, systematic reviews, and community participatory research.

The administrative needs of the Embark Program are overseen by appointed full-time medical education faculty members (Program Directors) supported by a Program Coordinator. Each preclinical Embark course includes sessions delivered by faculty who are recruited to teach in areas of their unique expertise. These faculty include educators from within the medical school, university, and voluntary instructors from the community.

Developing Early Preclinical Experiences With Teamwork and Interprofessional Team Environments

As developing skills and experiences with interprofessional teams is an important component of several of the desired EPA behaviors and competencies, the Embark Program has sought to continuously bolster early preclinical opportunities for interprofessional interactions and team building.^{1–3} Beginning in their first year of study, students participate in the Embark Program's research training courses, where they have the opportunity to work with a wide range of basic science and clinical research faculty, medical education staff, librarians, and community members. Examples of student preclinical experiences resulting from these interactions include but are not limited to understanding and navigating the electronic medical record system, conducting study participant interviews/focus groups in both clinical and community settings, and participating in program development of our community partners, such as energy insecurity for children, local homeless and women's shelters, and economic support for families of cancer patients.

Regardless of each student's specific project regulatory requirements, all students learn from medical humanities faculty about Institutional Review Board (IRB) regulations as well as important historical developments and principles in ethics. Students are also introduced to IRB application components through content provided by medical school staff, representatives from both the university and health system IRB

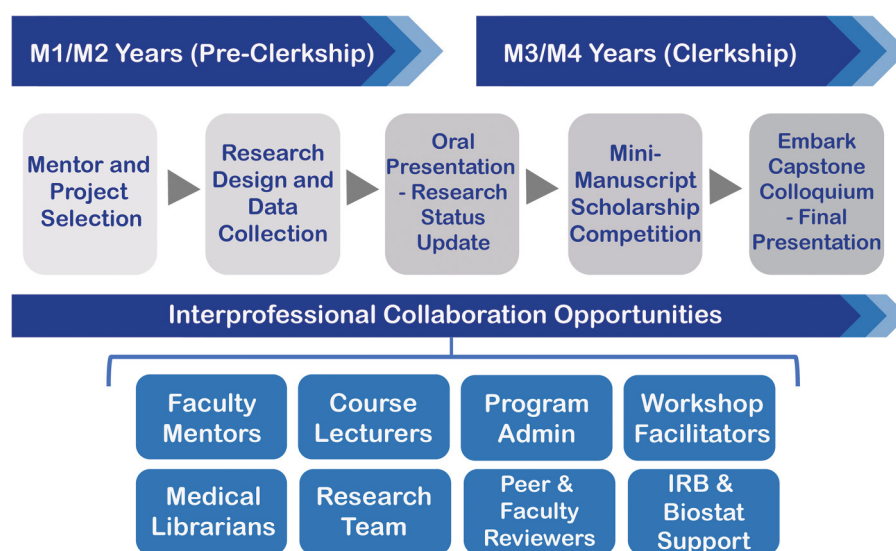


Figure 1. The Embark Program longitudinal structure and the intersectionality of interprofessional collaborators' program involvement. The major milestones within the Embark Program (center) are aligned within the overarching curriculum. Throughout the Embark Program structure, students have opportunities to interact with multiple interprofessional collaborators.

committees, and representatives from the office of data security. Also in the first year, students are introduced to best practices in preparing for statistical consultation and creating a data code-book through a workshop led by medical epidemiology faculty and statisticians. First-year students also interact with library faculty, who deliver early sessions on information searching and management, systematic reviews, resources for funding, writing scientific abstracts and publishing, as well as providing individualized feedback to all students on search strategies and research project resources. Additionally, students engage with clinical faculty members, who provide content on professionalism in a clinical setting and research team communication. University faculty from the School of Music, Theatre and Dance facilitates workshops on clinical improvisation and public speaking prior to the students' second-year oral presentation milestone. These workshops have included content regarding vocal coaching, opportunities to have hands-on experiences with public speaking and projecting to a large audience, and improvisation exercises designed to support clinical and scientific presentation skills.

Finally, students unite with mentors and research team members from a variety of disciplines, who provide expertise in different research areas, and support the large number of projects represented by the Embark Program. Mentors assist students in the development of a novel research question that explores an area of mutual interest, and they provide support throughout the research project including oversight and approval of research milestones. Embark mentors are as diverse as the students they mentor. The mentors' areas of expertise range from clinical to nonclinical fields, such as Legal Aid for Children and Families, Reading and Language Arts, and K-12 education. By allowing the students to gain

familiarity in interacting with interprofessional teams in safe spaces, the Embark Program provides a rich environment to develop transferable skills in teamwork and interprofessional activities in the preclinical curriculum.

Supporting the Development of Clinical Communication Skills

The Embark Program offers 3 milestone events where students have the opportunity to communicate their research to stakeholders and the professional community: an oral presentation, a mini-manuscript competition, and a final poster presentation (Figure 1). These milestones provide students with opportunities to practice communication in a variety of different environments. One of these opportunities is competitive, with scholarships tied to the mini-manuscript competition. All 3 events are planned and supervised by a diverse committee of research experts who developed submission instructions, scoring rubrics, and training materials for reviewers and judges. Adjudication of the mini-manuscript competition is conducted by reviewers and judges solicited from the ranks of OUWB and Oakland University faculty and include basic scientists, clinicians, and librarians. These faculty provide expert feedback to each student regarding student presentation skills, writing skills, and organization of their research so that they may incorporate the feedback into future research and clinical presentations. Additionally, students working with clinical project mentors further hone their presentations or written research products promoting the practice of communicating to a clinical supervisor. Students have routinely described in course evaluations the benefit of these Embark research communication milestones—both for pushing them outside of their comfort zone while still in the preclinical curriculum

and providing a valuable opportunity to practice clinical and scientific communication skills. Course evaluation comments frequently include sentiments such as:

- “Though the presentations for Embark were very scary at first, at the end of it I realized that it was a very valuable experience.”
- “I like that the final project is a presentation. We get to practice our skills in a more familiar and less intimidating setting.”
- “I thought that having to prepare the oral presentation was really good practice for learning how to talk about my research. That was my very first “research presentation,” so I was glad to have the opportunity to try it and get feedback.”
- “I really enjoyed Embark since we got to write abstracts (again, my first ever) and put together presentations, which I think helped me work on public speaking and allowed me to receive feedback from judges and classmates about my project—really the only time I’ve discussed my research with anyone outside my mentor and Embark faculty. I liked that public speaking sessions were offered”... “I did participate in a session with [Theater Professor] and really enjoyed myself. I tried to apply the things I learned in that session during my presentation ...!”

A Preclinical Opportunity to Practice Self-Regulated Learning and Time Management Through Research

Medical student research training programs provide unique opportunities to practice self-regulated learning and time management via independent research projects. Throughout various transition points in medical school, including early in the pre-clinical years and entry into the clerkship years, the forward progression of students’ research projects is often impeded as they attempt to balance the new responsibilities and expectations of each stage of medical school. During these transitional times, students must evaluate their circumstances and plan attainable incremental steps to continue the development of their project. The opportunity exists in scholarly concentration programs to devise program milestones in a manner that can enhance the experience with self-regulated learning techniques. DiBenedetto (2011) nicely summarized Zimmerman & Pons’s (1986) definition of self-regulation as “learners’ beliefs about their capability to engage in appropriate actions, thoughts, feelings, and behaviors in order to pursue valuable academic goals, while self-monitoring and self-reflecting on their progress toward goal-completion.”^{34,35} Recognizing an opportunity to advance self-regulated learning within the Embark Program, course content has been developed to include operationalization tips and time management strategies. For example, Individual Research Plans (IRPs) require students to provide regular project updates and have evolved to include student-developed

short-term and longitudinal benchmarks with frequent self-evaluations. The design of the IRPs offers an opportunity for students to practice establishing their own benchmarks for project success by evaluating their current status and progress toward their project goals. Students reflect on any hurdles that impeded progress at the time of report and devise new strategies to adjust their trajectory. Mentors and Program Directors both have the opportunity to provide feedback on each student’s IRP and offer individualized support on self-regulated learning and time management skill development. Continued time management and operationalization practice during the conduct of research is directly transferable to the management of clerkship directors’ expectations.¹³ We believe this model of IRPs with benchmarks to be an easily implemented and productive tool to develop and assess several key entrustable behaviors and promote self-directed and self-regulated learning in medical students.

Residency Directors Recognize the Value of Research Experiences

In the interest of nation-wide UME program evaluation, since 2016, all residency program directors have been administered a survey and asked to reflect on the preparation of their interns. For program directors assessing OUWB alumni, this survey also includes questions that serve as a curricular evaluation of the OUWB Embark Program. One question addresses the OUWB alumni’s familiarity with various aspects of research design, including teamwork and interprofessional education, communication, and self-regulated learning and time management. Since 2018, 66.2% of program directors (n = 111) that worked with OUWB graduates assessed the students as being prepared or very prepared in these domains (specifically questions asked about the ability of alumni to engage in specific areas of research: search and appraise biomedical literature, write a research abstract, present a research study, produce a research poster, communicate with a research team, implement and manage a project, and manage time). Using this information as an indirect indicator of the impact/influence of Embark on student skills relating back to the transferable skill sets of self-directed learning, communication and time management mentioned previously program directors feel that OUWB alumni gained valuable research-related skills during their training, likely through the Embark Program. Not only are these skills recognized as important but they are maintained from UME, demonstrating early and frequent practice to be of benefit.

Undergraduate Research as an Opportunity

The goal of any research training course is principally to instruct students to understand the process of conducting research toward the generation of new knowledge or increased understanding in a particular topic area. The research projects themselves are often touted as examples of student self-directed

learning. But while efforts are placed to this end, the potential for these research training experiences to provide so much more toward the development of well-formed clinicians is substantial. Areas of competency that focus on teamwork, communication, organization and time management, and self-directed/self-regulated learning all in an interprofessional environment as exemplified in the EPAs can be built into the framework of a research training course to allow for these practice opportunities. This dual purpose of not only instructing students in the conduct of research but also in the skill sets relevant to transition to residency make undergraduate medical research of unique value, particularly in preclinical years where such opportunities are challenging to promote in the broader curriculum. Careful planning and development of course requirements to include practice in these areas is all that is necessary to provide an enriching experience for students well beyond the traditional undergraduate research intention.

Acknowledgments

Robin Rivest, MEd, MBA, Director of Curriculum Data Management, for providing the annual residency program director survey data and James Grogan, PhD for critical review and thoughtful contributions to the manuscript.

ORCID iD

Kara E Sawarynski  <https://orcid.org/0000-0003-3008-0884>
 Stephanie M Swanberg  <https://orcid.org/0000-0003-0553-8339>
 Victoria A Roach  <https://orcid.org/0000-0003-4020-2224>
 Tracey AH Taylor  <https://orcid.org/0000-0002-4739-7127>

REFERENCES

- Association of American Medical Colleges. The Core Entrustable Professional Activities (EPAs) for Entering Residency. 2014. Accessed June 18, 2021. <https://www.aamc.org/what-we-do/mission-areas/medical-education/cbme/core-epas>
- Englander R, Cameron T, Ballard AJ, Dodge J, Bull J, Aschenbrener CA. Toward a common taxonomy of competency domains for the health professions and competencies for physicians. *Acad Med*. 2013;88:1088-1094.
- Meyer EG, Chen HC, Uijtdehaage S, Durning SJ, Maggio LA. Scoping review of entrustable professional activities in undergraduate medical education. *Acad Med*. 2019;94:1040-1049.
- Eckstrand KL, Potter J, Bayer CR, Englander R. Giving context to the Physician Competency Reference Set: adapting to the needs of diverse populations. *Acad Med*. 2016;91:930-935.
- Hawkins RE, Welcher CM, Holmboe ES, et al. Implementation of competency-based medical education: are we addressing the concerns and challenges? *Med Educ*. 2015;49:1086-1102.
- Caverzagie KJ, Nussli MT, Ferguson PC, et al. Overarching challenges to the implementation of competency-based medical education. *Med Teach*. 2017;39:588-593.
- Atherley A, Dolmans D, Hu W, Hegazi I, Alexander S, Teunissen PW. Beyond the struggles: a scoping review on the transition to undergraduate clinical training. *Med Educ*. 2019;53:559-570.
- Surmon L, Bialocerkowski A, Hu W. Perceptions of preparedness for the first medical clerkship: a systematic review and synthesis. *BMC Med Educ*. 2016;16:89.
- Clay AS, Andolsek K, Grochowski COC, Engle DL, Chudgar SM. Using transitional year milestones to assess graduating medical students' skills during a capstone course. *J Grad Med Educ*. 2015;7:658-662.
- Fürstenberg S, Harendza S. Differences between medical student and faculty perceptions of the competencies needed for the first year of residency. *BMC Med Educ*. 2017;17:198.
- Malau-Aduli BS, Roche P, Adu M, Jones K, Alele F, Drovandi A. Perceptions and processes influencing the transition of medical students from pre-clinical to clinical training. *BMC Med Educ*. 2020;20:279.
- Peterson LN, Rusticus SA, Eva KW, et al. Using the readiness for clerkship and residency surveys to evaluate the effectiveness of four MD programs: a cross-institutional generalizability study. *Acad Med*. 2017;92:S100-S109.
- Wenrich M, Jackson MB, Scherpbier AJ, Wolfhagen IH, Ramsey PG, Goldstein EA. Ready or not? Expectations of faculty and medical students for clinical skills preparation for clerkships. *Med Educ Online*. 2010;15.
- Cavalcanti M, Fernandes AK, McCallister JW, et al. Post-clerkship curricular reform: specialty-specific tracks and entrustable professional activities to guide the transition to residency. *Med Sci Educ*. 2021;31:851-861.
- Duijn CCMA, Welink LS, Bok HGJ, ten Cate OTJ. When to trust our learners? Clinical teachers' perceptions of decision variables in the entrustment process. *Perspect Med Educ*. 2018;7:192-199.
- Lyss-Lerman P, Teherani A, Aagaard E, Loeser H, Cooke M, Harper GM. What training is needed in the fourth year of medical school? Views of residency program directors. *Acad Med*. 2009;84:823-829.
- Mattar SG, Alseidi AA, Jones DB, et al. General surgery residency inadequately prepares trainees for fellowship: results of a survey of fellowship program directors. *Ann Surg*. 2013;258:440-447.
- Murray KE, Lane JL, Carraccio C, et al. Crossing the gap: using competency-based assessment to determine whether learners are ready for the undergraduate-to-graduate transition. *Acad Med*. 2019;94:338-345.
- Association of American Medical Colleges. Medical student research in the contemporary medical school curriculum. *Curric Inven Context*. 2018;5:1-7.
- Stone C, Dogbey GY, Klenzak S, Van Fossen K, Tan B, Brannan GD. Contemporary global perspectives of medical students on research during undergraduate medical education: a systematic literature review. *Med Educ Online*. 2018;23.
- Chang Y, Ramnanan CJ. A review of literature on medical students and scholarly research: experiences, attitudes, and outcomes. *Acad Med*. 2015;90:1162-1173.
- Sawarynski KE, Baxa DM, Folberg R. Embarking on a journey of discovery: developing transitional skill sets through a scholarly concentration program. *Teach Learn Med*. 2019;31:195-206.
- American Association of Colleges of Osteopathic Medicine, Association of American Medical Colleges, Accreditation Council of Graduate Medical Education, Educational Commission for Foreign Medical Graduates | Foundation for Advancement of International Medical Education and Research. Transition in a time of disruption: Practical guidance to support the move from undergraduate medical education to graduate medical education. . 2021. Accessed September 24, 2021. <https://www.aacom.org/docs/default-source/default-document-library/recommendations-for-ume-to-gme-transition-3-24-2021-final.pdf>
- Liaison Committee on Medical Education. Functions and structure of a medical school. 2021. Accessed September 24, 2021. <https://lcme.org/publications/>
- Fong SF, Sakai DH, Kasuya RT, et al. Medical school hotline: Liaison Committee on Medical Education accreditation, part IV: pre-clerkship education. *Hawaii J Med Public Health*. 2016;75:48-51.
- Panda M, Desbiens NA. An "education for life" requirement to promote lifelong learning in an internal medicine residency program. *J Grad Med Educ*. 2010;2:562-565.
- Biglu MH, Nateq F, Ghofazadeh M, Asgharzadeh A. Communication skills of physicians and Patients' satisfaction. *Mater Sociomed*. 2017;29:192-195.
- Smith A. Speaking Language of Audience Critical to Good Communication, CMO Says. American Association for Physician Leadership. . 2018. Accessed September 24, 2021. <https://www.physicianleaders.org/news/speaking-language-of-audience-is-critical-to-good-communication-cmo-says>
- Developing effective communication skills. *J Oncol Pract*. 2007;3:314-317.
- Gordan VV, National Dental PBRN Collaborative Group. Translating research into everyday clinical practice: lessons learned from a USA national dental practice-based research network. *Tex Dent J*. 2014;131:590-599.
- Drummond D. Physician burnout: its origin, symptoms, and five main causes. *Fam Pract Manag*. 2015;22:42-47.
- Association of American Medical Colleges. . 2018. Accessed September 24, 2021. Medical School Graduation Questionnaire 2018 All Schools Summary Report. <https://www.aamc.org/media/9386/download>
- Sawarynski KE, Baxa DM. Utilization of an online module bank for a research training curriculum: development, implementation, evolution, evaluation, and lessons learned. *Med Educ Online*. 2019;24.
- DiBenedetto MK, Barry J. Zimmerman: an educator with passion for developing self-regulation of learning through social learning. Paper presented at: Annual Meeting of the American Educational Research Association; April 2011; New Orleans, LA.
- Zimmerman BJ, Pons MM. Development of a structured interview for assessing student use of self-regulated learning strategies. *Am J Educ Res*. 1986;23:614-628.