

Assessment of Medical Residents Technology Readiness for an Online Residents-as-Teachers Curriculum

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Objective: The University of Puerto Rico School of Medicine has a need to expand the current Residents-as-Teachers workshops into a comprehensive curriculum. One way to do so is to implement an online curriculum, but prior to this, the readiness of the medical residents to participate in such a curriculum should be assessed. Our objective was to determine whether the residents at the University of Puerto Rico School of Medicine are prepared to engage in an online Residents-as-Teachers program.

Methods: This was a descriptive, mixed-method–design study that collected qualitative and quantitative data using an online survey and a focus-group interview. The study was conducted with students from 11 of the residency programs at the University of Puerto Rico School of Medicine.

Results: More than 80% of the participating residents had the technical knowledge to engage in an online program; 90.5% thought an online Residents-as-Teachers course would be a good alternative to what was currently available; 87.5% would be willing to participate in an online program, and 68.6% of the residents stated that they preferred an online course to a traditional one.

Conclusion: Determinants of readiness for online learning at the University of Puerto Rico School of Medicine were identified and discussed. Our results suggest that the majority of the residents who participated in this study are ready to engage in an online Residents-as-Teachers program. The only potential barrier found was that one-third of the residents still preferred a traditional curriculum, even when they thought an online Residents-as-Teachers curriculum was a good alternative and were willing to participate in the course or courses forming part of such a curriculum. Therefore, prior to wide-spread implementation of such a curriculum, a pilot test should be conducted to maximize the presumed and eventual success of that curriculum. [*PR Health Sci J* 2014;33:51-57]

Key words: Clinical Education, Technology, Teaching Skills, Readiness Assessment, Medical Residents

Medical resident teaching skills and teaching effectiveness have been topics of research for more than 40 years (1). Residents have the responsibility of supervising and teaching medical students in different practice settings. This includes serving as role models for professionalism, teamwork, and compassionate care (2). Teaching medical residents how to teach is a critical area of academic preparation, so much so that all medical schools and residency programs in the US must address this issue if they are to be fully accredited (3, 4). There is evidence that traditional, workshop-based Residents-as-Teachers (RAT) courses improve resident teaching skills as assessed by learners and that further improvements in the development of said learners' self-assessment skills and self-confidence might be had through such courses (5–7). Unfortunately, residency programs have run up against multiple obstacles when implementing comprehensive RAT curricula, such obstacles include lack of resources, time limitations for faculty and residents, logistics problems, and lack

of “buy-in” from stakeholders such as heads of departments and attending physicians (6, 8).

The University of Puerto Rico School of Medicine (UPR-SOM) has a need to expand the current RAT workshops into a comprehensive curriculum. At the moment, first-year residents (and only them) are required to take a 4-hour RAT workshop, which covers basic teaching skills, prior to the beginning of their residency programs. There are no required workshops or activities for upper-level residents. These residents are the

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ones in supervisory and teaching roles and are the ones being evaluated in terms of their teaching skills. The contents of a comprehensive curriculum should focus on the teaching and supervisory competencies required of residents at the different levels of their training.

Implementing a mandatory, traditional workshop-based RAT curriculum for the various levels of the residency programs may be difficult because of the time limitations of the residents and faculty. On the other hand, since there is no consensus about the ideal course length, format, or timing of delivery of a RAT curriculum (5, 6), one option for implementing such a curriculum would be to offer alternative ways to conceptualize it and then offer it online. Implementing an online RAT curriculum would be a promising solution to overcoming the aforementioned difficulties and challenges that attend traditional delivery systems.

The development of an online RAT curriculum refers to the development of a complete curriculum that would be delivered online using a Web-based learning-management system. This flexible method of teaching, if applied effectively to a RAT curriculum, may solve the time-limitation and logistics problems that have been detailed, herein (9). There is evidence that online courses can be as effective as traditional methods of instruction in terms of knowledge acquisition (9, 10) and may be more effective than traditional methods in terms of skills acquisition (11). However, converting the RAT curriculum into an online format and getting ready for the implementation process would require a tremendous investment of time and resources (12, 13). Before this investment is made, the technology readiness of the potential users should be assessed. Such obstacles as are discovered through this assessment can then be addressed and neutralized during the design of the course, prior to its actual implementation (14).

Readiness for change is the cognitive process that takes place before supporting or resisting a change (15). Technology readiness refers to the natural tendency of a person to adopt and use new technologies (16). Therefore, a technology-readiness assessment for online learning should evaluate the acceptance of individuals of the need for change, the technical resources/needs of learners, the educational needs and preferences of said learners and their commitment to the use of this new technology, and the potential barriers to implementation (such as resistance to online learning, poor computer skills, lack of time, or the idea that the curriculum is not necessary) (9, 15). Taking all these factors into consideration, and to maximize the success of an online RAT curriculum, from May through August of 2009 we began the process of assessing the technology readiness of our residents in order to determine the plausibility of implementing an online RAT curriculum.

The purpose of this study, then, was to evaluate the technology readiness of residents at the UPR-SOM and to determine whether or not these individuals had the capacity

to participate in an online RAT curriculum. Around this focus, the following sub-questions guided the study:

- How do residents view online learning compared to traditional methods of instruction for a RAT curriculum?
- How do residents perceive their technical knowledge, competency skills, and personal attributes in terms of what is needed to participate in an online course?
- For residents, what are the expected barriers to and challenges of taking an online course?

Materials and Methods

Study design

This descriptive, mixed-method study employed an online survey and a focus-group interview to examine the technology readiness of the participating residents with respect to an online RAT curriculum.

Setting and participants

This study was conducted with a group of residents who were part of the residency programs that are themselves part of the Graduate Medical Education (GME) Associate Deanship at the UPR-SOM.

The intended subjects for the online survey were the 380 residents from the 36 GME programs. For the focus-group interview, we used a convenience sample of pediatric residents, knowing they were typical of the pediatric residents who would participate in a RAT curriculum but knowing also that they did not necessarily represent residents from other residency programs.

Instruments

Online- Learning -Readiness Assessment Survey: The 28-item survey was based on the Student Readiness Survey used in a similar research project at the Universidad San Francisco de Quito (17). The survey was composed of 3 main parts: Part 1 focused on resident readiness by evaluating the perceptions of residents with regard to their need to take an online RAT course, their self-directed learning competency, their attitudes towards learning how to use new technologies, and their preference between online learning and traditional learning. Part 2 addressed technical readiness by evaluating prior online learning experience and computer accessibility, knowledge, and expertise. Part 3 collected demographic information. Question formats varied, consisting of a combination of Likert-scale statements, multiple-choice questions, and open-ended questions, yielding a mixture of quantitative and qualitative data.

Focus-Group Interview Questions: The purpose of the 9-question interview was to capture further information on the residents' readiness to participate in an online RAT course. The questions, based on the Student Focus-Group Interview Questions used in a similar research project at the Universidad San Francisco de Quito (17), addressed both resident and

technology readiness by evaluating prior experiences with online courses, learning needs, learning preferences, motivation, attitudes, technology access, perceived benefits, and expected challenges and problems.

Validation: The face and content validity of each tool was evaluated with 3 methods: 1) using previously utilized survey and interview questions, which had already been shown to have face and content validity, as the basis for instrument and interview development (17); 2) comparing the questions in the survey and interview to those suggested in the readiness-assessment literature (9, 16-20); and 3) requesting the revision of the instruments by 2 education and content experts for clarity and intended content.

Data collection

Prior to data collection, approval was obtained from the University of Puerto Rico Medical Sciences Campus Institutional Review Board. (April 27, 2009; Protocol#1170109). Two methods of data collection were used: quantitative data were obtained from the online readiness-assessment survey, and qualitative data were obtained from the open-ended questions on the survey and from the focus-group interview.

Online survey: A cover letter was sent to the department heads and program directors of 36 residency programs, seeking their approval to send the survey via email to their residents. Only those residents whose department heads or program directors granted approval and provided the email addresses of said residents were included in the study. The Online- Learning- Readiness Assessment Survey was placed online using SurveyMonkey. An email message containing a request to participate in the study, a study description, and the SurveyMonkey link was sent to each of the 238 residents who had permission to participate. Reminder emails were sent every 2 weeks for a 1-month period, and a final reminder email was sent 1 week prior to closing the survey. The survey was open for completion from May 27 to August 31, 2009.

Focus Group: Residents in the General Pediatrics Residency Program at UPR-SOM were invited by their chief resident to participate in the focus group. Four residents participated in the group discussion: 3 senior residents (1 male and 2 females) and 1 second-year resident (female). The focus group was conducted at the University Pediatric Hospital in the chief resident's office, and the discussion lasted 1 hour and 20 minutes. This interview was audio-taped with the participants' permission, and the researchers took field notes.

Data analysis

Quantitative data were analyzed by SPSS using descriptive statistics, including response rate, frequency, and percentage of answer for each of the questions of the survey. Qualitative data from the survey's open-ended questions were analyzed using thematic analysis (22), until a final list of central themes was achieved.

Qualitative data from the focus-group interview were analyzed following grounded-theory techniques, going through the steps of developing an open coding, following this with axial coding, and ending with selectively staging the data into core themes and their subcategories (21, 22).

Results

The survey was completed by 105 of 238 residents for a 44% response rate (Table 1). Each of the residents was enrolled in one of 11 residency programs, which programs included 3 primary care programs (General Internal Medicine, General Pediatrics, and OBGYN); 4 surgical specialties (General Surgery, Orthopedic Surgery, and ENT and Ophthalmology); and the Gastroenterology, General Psychiatry and Child Psychiatry, Emergency Medicine, and Pathology and Laboratory Medicine residency programs. Five residents did not identify their residency programs. The highest response rates were from Emergency Medicine and Gastroenterology (85% and 80%, respectively). The majority of the respondents were Hispanic (99%), 24 to 29 years old (71.2%), and female (61.5%).

One hundred percent (100%) of the participating residents reported having access to a personal computer and internet at home. Of the 105 residents who completed the survey, 41.3% rated their computer literacy as advanced, 56.7% rated their computer literacy as intermediate, and 1.9% reported themselves to be beginners. Ninety-four residents (89.5%) reported having used computers for 5 years or more, and 3 residents (2.8%) reported having used computers for fewer than 5 years.

One hundred and three residents (98.1%) had used word-processing software, 69 (65.4%) had used database software, and 80 (76%) had used graphics. Seventy-four percent (74%) had played computer games, 97.1% had experience with computer-based communications such as email and chat, and 99% had used a Web browser. Fifty-three residents (50.5%) reported having taken an online course; ninety-two residents (89.3%) reported having used a computer-based module, and eighty-seven (84.5%) reported that they had used either the WebCT or the Blackboard platform.

For 28 residents (26.75%), learning face-to-face was not important, while 52 (49.5%) thought it was somewhat important, and 25 (23.8%) thought it was very important.

Twenty-eight residents (26.9%) reported their need to take the RAT course online as high, while 66 (62.5%) reported that they could take the RAT course online or through the workshops offered by the Faculty Development Program. Eleven residents (10.6%) reported the need to take the RAT course online as low.

The overwhelming majority of residents, 88 (83.8%), reported that they looked forward to learning new technologies, while 15 residents (14.3%) reported being a little nervous but

that they would try them anyway. Only 2 residents (1.9%) reported putting off or avoiding learning new technologies.

The respondents' willingness to participate in and preferences for an online RAT curriculum are illustrated in Figures 1 and 2. As can be seen in Figure 1, 95 residents (90.5%) reported thinking that an online RAT course would be a good alternative to a traditional one, while 92 (87.5%) responded that they would be interested in participating in an online RAT course. Seventy-two residents (68.6%) responded that they would prefer an online RAT curriculum, while 33 (31.4%) reported that they would prefer a traditional RAT course. The differences by age distribution and by gender with regard to preferences for online and traditional RAT courses can be seen in Figure 2. Around seventy-two percent (71.6%) of the 24- to 29-year-old residents and 62.1% of the 30- to 39-year-old residents said that they would prefer an online RAT course to a traditional one. Eighty-seven point five percent (87.5%) of the participating female residents had this preference compared to 65% of the participating male residents. Two central themes predominated in the thematic analysis of the open-ended survey questions: the residents' need for RAT training and the positive characteristics of an online curriculum.

Residents' need for RAT training: The majority of the respondents thought that an online RAT course would provide them with the skills needed to become effective teachers, leaders, and mentors. When asked what they expected to gain from an online RAT course, the most common answers were the following:

"Improve my teaching skills"

"The necessary preparation to be an effective teacher and mentor"

Positive characteristics of an online curriculum: The majority of respondents thought an online format would be more convenient and efficient, offering the flexibility to study in the comfort of their homes when they had the time to concentrate on the topic. The following were two of the frequent comments regarding an online RAT curriculum:

"Can be reviewed off hours"

"More suitable for our schedules"

The analysis of focus-group-interview data yielded 3 major core themes: support for online learning, barriers for implementing an online RAT curriculum, and aids for implementing an online RAT curriculum. Under each of these, several subcategories emerged.

Support for online learning: Four subcategories predominated in the residents' discussion of their support for an online RAT curriculum. The first subcategory was the perceived need for RAT training, with all the participating residents agreeing on the need to be trained as teachers because 1) they would apply what they learned to immediate situations and 2) they already taught in different settings.

The second subcategory was the positive characteristics of an online curriculum, with the most frequently mentioned being the ability to manage study time. The third subcategory was the perception, shared by all the residents, that an online RAT curriculum was a good alternative to a traditional one. Reasons given included:

"I think it is a good idea because these are new times full of technology. We use email daily; therefore, we can log on to the course for 15 minutes, any time."

"The fact that I can review concepts over and over makes it a good alternative."

The fourth subcategory was technical preparedness. All the residents had taken an online HIPAA course, all had used WebCT or Blackboard platforms, and all the residents believed they had the technical skills needed to complete an online RAT course.

Barriers to implementing an online RAT curriculum: Two subcategories were prevalent in the discussion of barriers. The first one had to do with negative prior experiences with online courses and how such an experience could predispose a person towards a negative view of an online RAT course. The second subcategory was time: Residents viewed time as a barrier to implementation because of the need to find time to log in for course work and participation. However, residents also countered this barrier, stating that an online curriculum could be completed at any time and from any place.

Aids for implementing an online RAT curriculum: In terms of overcoming the barriers found, residents discussed 3 ways to maximize the success of implementing an online RAT curriculum and achieving a high resident-participation rate. The first was the technology and skills required for an online RAT curriculum. Residents agreed that an internet-connected computer was a basic necessity, but also expressed the need for a user-friendly platform and clear explanations for how to quickly navigate through the different links.

The residents also agreed that individual motivations for participating in an online course should be taken into consideration when designing the course. Yet, all had different motivations:

"... personal gain, for example a certificate of completion that could be part of your CV."

"Knowing that I will be able to teach what I am learning is motivation enough for me."

"Placing deadlines for finishing each module would be an appropriate motivation to complete them."

"We hate tests, but they do motivate us."

Finally, although not directly asked in any of the focus-group questions, the residents kept returning to the theme of the recommended course structure for an online RAT curriculum. They recommended presenting information in short content blocks, using a combination of PowerPoint interactive media and self-assessment.

Table 1. Demographic data and distribution of residents' and fellows' return rate of online survey, per program

Residency or fellowships program	No. invited to participate	No. of respondents completing the survey	Response rate (%)	Age	Level of training	Gender	Ethnicity
General internal medicine	51	14	28%	24 – 29 = 10 30 – 39 = 4	PG I = 4, PG II = 4, PG III = 6 PG IV or greater = 0	F = 7 M = 7	Hispanic = 14
General pediatric residents	22	11	50%	24 – 29 = 9 30 – 39 = 2	PG I = 4, PG II = 2, PG III = 4 PG IV or greater = 1	F = 9 M = 2	Hispanic = 11
General surgery	36	14	39%	24 – 29 = 11 30 – 39 = 3	PG I = 9, PG II = 1, PG III = 2 PG IV or greater = 2	F = 4 M = 10	Hispanic = 14
Orthopedic surgery	21	5	24%	24 – 29 = 5 30 – 39 = 0	PG I = 2, PG II = 0, PG III = 3 PG IV or greater = 0	F = 3 M = 2	Hispanic = 5
ENT	7	2	29%	24 – 29 = 2 30 – 39 = 0	PG I = 0, PG II = 1, PG III = 1 PG IV or greater = 0	F = 2 M = 0	Hispanic = 2
General psychiatry and Child psychiatry	28	13	46%	24 – 29 = 10 30 – 39 = 3	PG I = 2, PG II = 4, PG III = 2 PG IV or greater = 5	F = 9 M = 4	Hispanic = 13
Emergency medicine	13	11	85%	24 – 29 = 8 30 – 39 = 3	PG I = 3, PG II = 5, PG III = 3 PG IV or greater = 0	F = 7 M = 4	Hispanic = 11
Pathology and Laboratory medicine	12	6	50%	24 – 29 = 3 30 – 39 = 2 40 – 49 = 1	PG I = 4, PG II = 1, PG III = 1 PG IV or greater = 1	F = 4 M = 2	Hispanic = 6
OB-GYN	22	9	41%	24 – 29 = 7 30 – 39 = 2	PG I = 4, PG II = 1, PG III = 2 PG IV or greater = 2	F = 9 M = 0	Hispanic = 9
Gastroenterology	10	8	80%	24 – 29 = 1 30 – 39 = 7	PG I = 0, PG II = 0, PG III = 0 PG IV or greater = 8	F = 3 M = 5	Hispanic = 8
Ophthalmology	16	7	44%	24 – 29 = 5 30 – 39 = 2	PG I = 1, PG II = 3, PG III = 0 PG IV or greater = 3	F = 5 M = 2	Hispanic = 7
Did not identify a residency program		5		24 – 29 = 3 30 – 39 = 1	PG I = 3, PG II = 1, PG III = 0 PG IV or greater = 0	F = 2 M = 2	Hispanic = 0 Other (Puerto Rican) = 4 (this was self-reported?)
Total percentages	238	105	44%	24 – 29 = 71.2% 30 – 39 = 27.9% 40 – 49 = 1.0%	PG I = 36%, PG II = 22.1% PG III = 23.1% PG IV or greater = 20.2%	F = 61.5% M = 38.5%	Hispanic = 99% No response = 1%

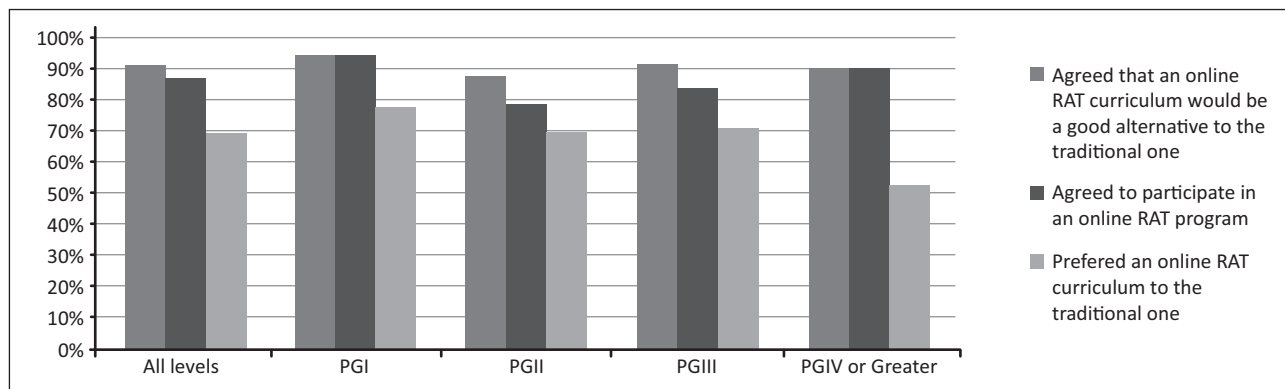


Figure 1. Residents' Willingness to Participate in and Preferences for an Online RAT Curriculum, Distributed by Training Level

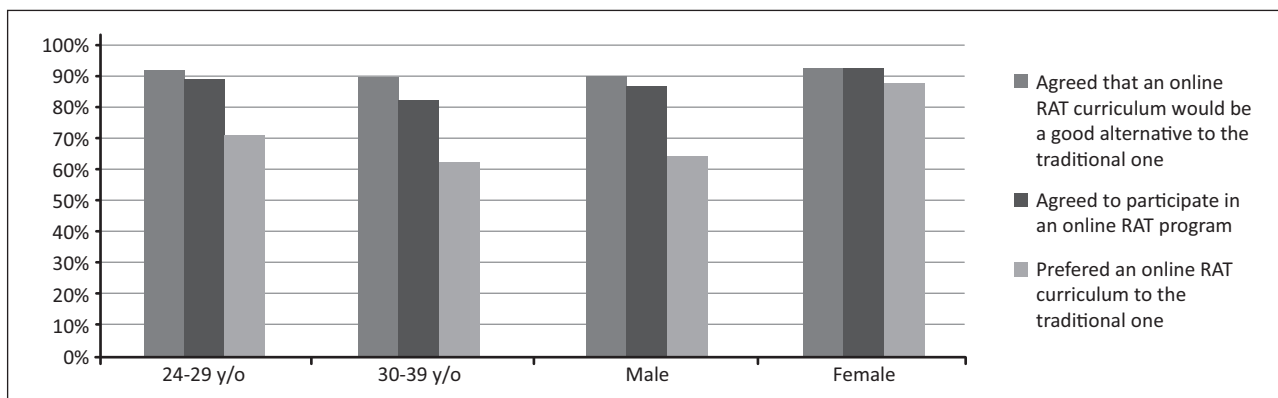


Figure 2. Residents’ Willingness to Participate in and Preferences for an Online RAT Curriculum, Distributed by Age Group and Gender

Discussion

Our results suggest that the majority of the residents who participated in this study were ready to engage in an online Residents-as-Teachers program because they possessed the technical skills and the self-directed learning skills required to participate. These individuals thought that RAT training was essential, and they viewed the online RAT curriculum as a good alternative to the more traditional one and were willing to participate in courses that formed part of such a curriculum.

One striking result, which may be a potential barrier to implementing an online RAT curriculum, was that one-third of the residents still preferred a traditional curriculum, even when they thought an online RAT curriculum was a good alternative and were willing to participate in courses within such a curriculum. This finding is consistent with prior research showing evidence that even when residents accept and use online learning as an educational method (14, 23), many still prefer traditional teaching methods (10). The literature does not specify a recommended percentage or rate of participant acceptance of change sufficient to deem a group ready for that change. Even though the majority of residents seemed ready and willing to change, we needed to ask ourselves whether those still holding a preference for traditional learning would have a negative impact on our implementation efforts, especially since the literature suggests that a social group can shape the readiness of others (15).

An interesting finding in our study is that more female than male residents preferred the online curriculum. The literature regarding gender differences in medical residents’ technology readiness and online learning is lacking, and studies with medical students are non-conclusive. Some studies have found male students to be more technology ready (24), while other studies have found that female students use online learning resources more frequently than male students do (25).

“Creating readiness involves proactive attempts by a change agent to influence the beliefs, attitudes, intentions, and behavior

of change participants” (15, p. 280). To create in our residents the readiness to participate in an online RAT curriculum, we believe that the design of the curriculum should take into consideration the residents’ recommendations regarding course structure. We also understand that in order to minimize resistance during the widespread implementation of such a course, we would need to first pilot the curriculum with a group of residents meeting all the requirements for engaging in an online curriculum, including a preference for an online learning format. If the curriculum is evaluated positively by the residents in the pilot study, we will be able to persuade other residents of the advantages of online learning and obtain learner buy-in. Then we will move towards full implementation, thus following the recommendations of the literature on how to create readiness (15).

The study had several limitations. The convenience sample of residents in the focus group limits the generalizability of the results across residency programs. In addition, one could speculate that the method of delivering the survey (by email) may have biased the subject sample towards those possessing the computer skills and resources required for online learning, marginalizing those residents without such skills or resources. Finally, cultural factors inherent to UPR-SOM may influence the preference of traditional over online learning methods.

Further research evaluating change-readiness assessments is needed in medical education. Research is necessary to define the minimum standards for deeming a group of health care professionals, including physicians, ready to implement a change. Once we have defined these minimums, a readiness assessment could be part of the needs assessment that would be performed prior to implementing any curriculum in the medical-education continuum.

In conclusion, most of the residents participating in this study at the UPR-SOM were ready to engage in an online Residents-as-Teachers Curriculum. Therefore, the next step is the design and implementation of the curriculum, but prior to a widespread implementation, we recommend pilot testing the curriculum to maximize its success.

Resumen

Objetivo: La Escuela de Medicina de la Universidad de Puerto Rico debe expandir los talleres de Residentes-como-Maestros a un currículo comprensivo. Una opción sería el implementar un currículo utilizando el internet o en línea, pero previo a su implementación se debe hacer una evaluación de la preparación tecnológica de los residentes para este tipo de currículo. El objetivo de este estudio fue determinar la preparación de los médicos residentes de la Escuela de Medicina de la Universidad de Puerto Rico para participar de un currículo en línea. **Metodología:** Este estudio fue descriptivo de metodología mixta en el cual se recopiló data cualitativa y cuantitativa a través de un cuestionario en línea y una entrevista a un grupo focal. Se llevó a cabo en 11 de los programas de residencia de la Escuela de Medicina de la Universidad de Puerto Rico. **Resultados:** Más del 80% de los residentes tienen el conocimiento técnico para participar de un currículo en línea; 90.5% piensan que un currículo de Residentes-como-Maestros en línea es una buena alternativa; 87.5% están dispuestos a participar en un currículo en línea y 68.6% de los residentes prefieren tomar cursos en línea a la manera tradicional. **Conclusión:** Se discutieron determinantes de preparación para tomar cursos en línea en la Escuela de Medicina de la Universidad de Puerto Rico. Los resultados sugieren que la mayoría de los residentes que participaron en el estudio están preparados para tomar un currículo en línea. La única posible barrera que se encontró fue que una tercera parte de los residentes prefiere el currículo tradicional aun cuando piensen que un currículo de Residentes-como-Maestros en línea es una buena alternativa y estén dispuestos a participar en él. Por lo tanto, antes de la implementación global de un currículo en línea, se debe hacer un piloto para maximizar el éxito del mismo.

References

- Edward JC, Friedland JA, Bing-You R, eds. *Residents' Teaching Skills*. New York, NY: Springer Publishing; 2002.
- Bordley DR, Litzelman DK. Preparing residents to become more effective teachers: A priority for internal medicine. *Am J Med* 2000;109:693-6.
- ACGME (Accreditation Council for Graduate Medical Education). *Program Directors Guide to the Common Program Requirements*. Chicago IL: Accreditation Council for Graduate Medical Education; 2008.
- LCME (Liaison Committee on Medical Education). *Functions and Structure of a Medical School: Standards for the Accreditation of Medical Education Programs Leading to the MD Degree*. Washington, DC, and Chicago, IL: Association of American Medical Colleges and the American Medical Association; 2012.
- Post R, Quattlebaum RG, Benich JJ 3rd. Residents-as-Teachers Curricula: A Critical Review. *Acad Med* 2009;84:374-80.
- Wamsley MA, Julian KA, Wipf JE. A literature review of "resident-as-teacher" curricula: Do teaching courses make a difference? *J Gen Int Med* 2004;19:574-81.
- Hill A, Yu T, Barrow M, Hattie J. A systematic review of resident-as-teacher programmes. *Med Educ* 2009;43:1129-40.
- Morrison EH, Rucker L, Boker JR, Hollingshead J, Hitchcock MA, Prislun MD, Hubell FA. A pilot randomized, controlled trial of a longitudinal residents-as-teachers curriculum. *Acad Med* 2003;78:722-9.
- Cook DA, Dupras DM. A Practical Guide to Developing Effective Web-based Learning. *J Gen Intern Med* 2004;19:698-707.
- Smith SF, Roberts NJ, Partridge MR. Comparison of a web-based package with tutor-based methods of teaching respiratory medicine: Subjective and objective evaluations. *BMC Med Educ* 2007;7:41.
- Xiao Y, Seagull JF, Bochicchio GV, Guzzo JL, Dutton RP, Sisley A, et al. Video-based training increases sterile-technique compliance during central venous catheter insertion. *Crit Care Med* 2007;35:1302-6.
- Boettcher JV, Conrad R-M. *Faculty Guide for Moving Teaching and Learning to the Web*. 2nd ed. Phoenix, AZ: League for Innovation in the Community College; 2004.
- Waterhouse S. *The Power of eLearning: The Essential Guide for Teaching in the Digital Age*. Boston, MA: Pearson/Allyn and Bacon; 2005.
- Cook DA, Dupras DM. Teaching on the Web: automated online instruction and assessment of residents in an acute care clinic. *Med Teach* 2004;26:599-603.
- Jennett PA, Gagnon MP, Brandstadt HK. Preparing for Success: Readiness Models for Rural Telehealth. *J Postgrad Med* 2005;51:279-85.
- Parasuraman A. The Technology Readiness Index (TRI): A Multiple-Item Scale to Measure Readiness to Embrace New Technologies. *J Serv Res* 2000;2:307-20.
- Mantilla G, Lewis KO. Determining Faculty and Student Readiness for an Online Medical Curriculum. *Med Sci Educ* 2012;22:228-43.
- Hamilton RJ, Pinto T, Carr MM. Internet-Based Continuing Medical Education in Otolaryngology: A Survey of Canadian Otolaryngologists. *J Otolaryngol* 2003;32:239-44.
- Pusic MV. Pediatric Residents: Are They Ready to Use Computer-Aided Instruction? *Arch Pediatr Adolesc Med* 1998;152:494-8.
- Snyder RA, Fields WL. Measuring Hospital Readiness for Information Technology (IT) Innovation: A Multisite Study of the Organizational Information Technology Innovation Readiness Scale. *J Nur Meas* 2006;14: 45-55.
- Miles MB, Huberman AM. *Qualitative Data Analysis: An Expanded Sourcebook*. 2nd Ed. Thousand Oaks, CA: SAGE Publications; 1994.
- Shank GD, ed. *Qualitative Research: A Personal Skills Approach*. 2nd ed. Upper Saddle River, NJ: Pearson Merrill Prentice Hall; 2006.
- Cochran A, Edelman LS, Morris SE, Saffle JR. Learner satisfaction with web-based learning as an adjunct to clinical experience in burn surgery. *J Burn Care Res* 2008;29:222-6.
- Caison AL, Bulman D, Pai S, Neville D. Exploring the technology readiness of nursing and medical students at a Canadian University. *J Interprof Care* 2008;22:283-94.
- Romanov K, Nevgi A. Do medical students watch video clips in eLearning and do these facilitate learning? *Med Teach* 2007;29:490-4.