

# Validation method of research instruments for Dental Radiology curriculum study

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## ABSTRACT

Dental radiology is an important subject to Dental undergraduate education. Along with other disciplines, it plays a key role in diagnostics, the starting point for patient care. In this way, a specific international guideline for Dental Radiology curriculum was published in 2007. The aim of this study was to develop and validate two distinct instruments, a self-administered online survey, and an interview script, both designed for dental radiology education research. The processes for developing and validating the instruments are described, and the final documents are presented. There were several steps in the validation process of the research instruments in this study, such as translation, cultural adaptation, expert evaluation, read-aloud sessions and pilot testing. This detailed process guarantees control of the variables and helps to avoid bias in regard to the interview and the quantitative/qualitative method analysis.

**Descriptors:** Education. Learning. Radiology. Dentistry. Qualitative Research. Validation Studies. Interview.

## 1 INTRODUCTION

Dental radiology is an important subject to undergraduate dental education. Along with other disciplines, it plays a key role in diagnostics, the starting point for patient care. In 1997, the American Dental Education

Association (ADEA) identified concerns for the quality of dental education and proposed a new curriculum model and related competencies. In 2011, the ADEA House of Delegates updated the Competencies for the New General Dentist guidelines which stated that the undergraduate

dental curriculum must provide the graduate dentist with the necessary skills for carrying out all activities involving prevention, diagnosis, and treatment of dental patients<sup>1,2</sup>. The graduate dentist is required to develop all major competencies such as professionalism, interpersonal communication and social skills, clinical information gathering, diagnosis and treatment planning, therapy and prevention. The same occurred in Brazil in 2001 through the National Curriculum Guidelines (Diretrizes Nacionais Curriculares, DCN)<sup>3</sup>. In 2007, originating from the International Association of Dentomaxillofacial Radiology (IADMFR) committee in education standards, specific guidelines for Dental Radiology curriculum were published<sup>4</sup>.

Many schools comply with these guidelines; others are still working toward compliance. Educational researchers raise questions about what is being taught, how and by whom. In 2013, a study<sup>5</sup> suggested that proactive participation, collaboration, and the inclusion of the students in their own educational process was beneficial to their learning. Stimulating critical thinking, eliciting student perceptions and giving adequate feedback to students' questions, along with transparent communication seems to be the direction of higher quality education.

The literature on social science research methods advocates the use of multiple methods, such as self-responded surveys<sup>6</sup>, open-ended surveys<sup>7</sup>, and interviews<sup>5</sup>; under the conception that qualitative and quantitative methods are complementary rather than rivals. Using both methods simultaneously is one way to strength the power and mitigate the weaknesses found in single method designs. Graduate training usually prepares students to use one method or another as appropriate and preferred, and rarely teaches how to combine methods effectively. Among those who use multiple methods, often they do not

explain their technique in sufficient detail to indicate precisely how convergent data are collected and interpreted<sup>8</sup>.

This study aimed to develop and validate two instruments; a self-administered online survey and an interview script, both designed for radiology professors to obtain a profile of the dental radiology education system, to better understand how schools approach teaching required domain and competencies, and to acquire the professors' perceptions of how radiology is taught.

## **2 INSTRUMENTS DEVELOPMENT AND VALIDATION PROCESSES**

The process for developing and validating the instruments was accomplished according to figure 1.

For the quantitative instrument, an initial set of 22 items was culled from the literature<sup>4</sup> and formulated in Portuguese. Questions aimed to identify different domains, competencies, and skills that a future dentist should acquire and then learn more about how curriculum aspects are implemented in the Dental Radiology curriculum. This initial version was discussed and enhanced by eight experts, Dental Radiology professors, in a 3-hour meeting during a Brazilian Dental Radiology conference. The validated version was professionally translated into English.

Upon ethical approval both in Brazil (CAAE: 16031213.4.0000.5349) and the United States (U. S) (IRB 2014-U-0578), the doctoral mentor recruited content experts for the focus group and asked them to assess the readability and clarity of the survey items. An e-mail explaining the purpose of the study was sent to four Dental Radiology faculty members in the U. S. A mutually convenient time was determined, consent for participation was obtained, and then the dissertation mentor moderated a 45-minute

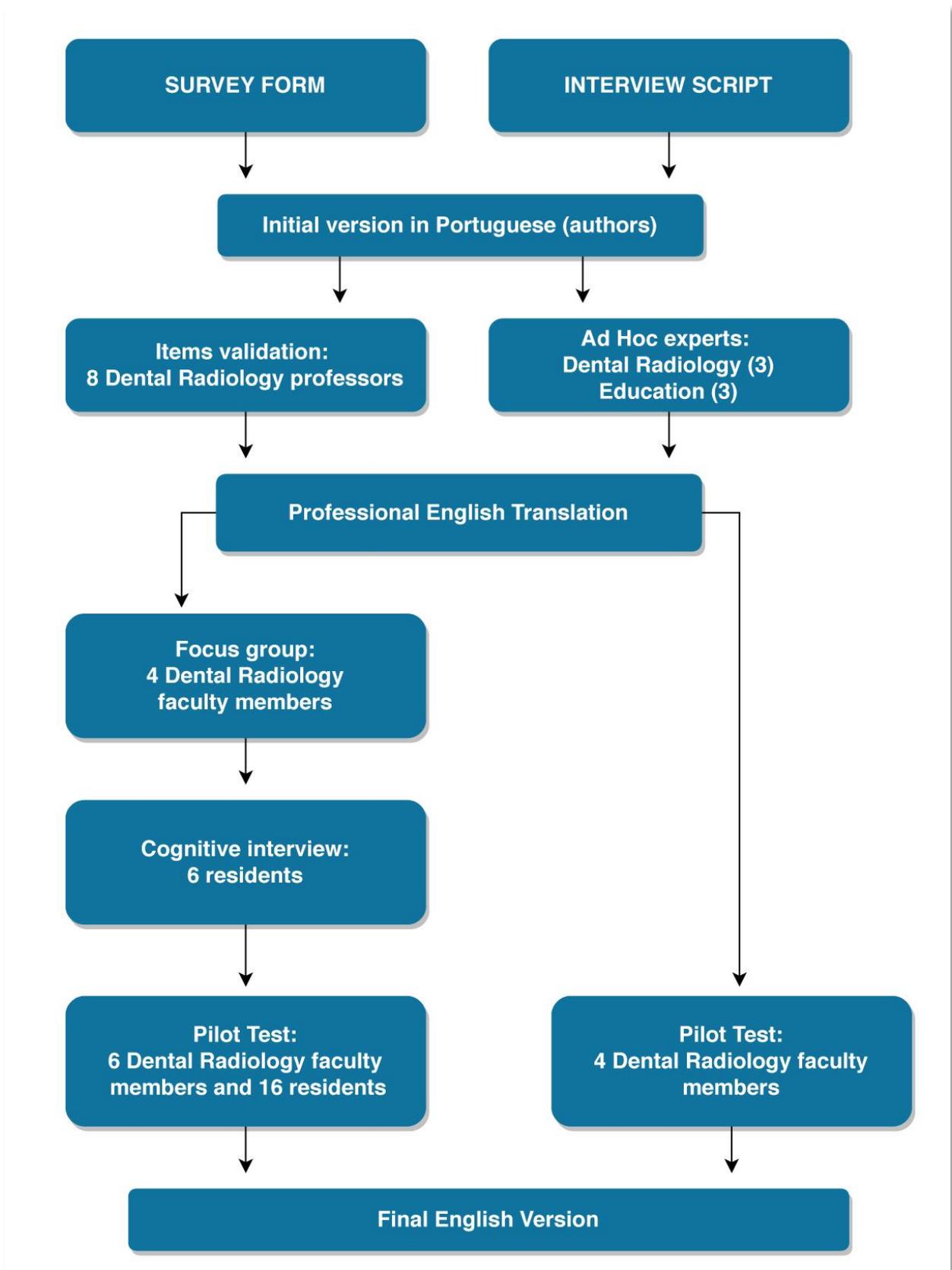


Figure 1. Validation steps of the instruments

virtual focus group aiming at ensuring that the content of survey was representative of the domain. The questions were read aloud to verify if they were clear and easy to understand and were being interpreted as intended<sup>9</sup>. Each professor offered suggestions that were discussed with the group. Three questions that addressed technologies or practices no longer used in the U. S. were removed. Several survey items were language revised to enhance their clarity.

Next, six residents from the Diagnostics Science Department were invited to participate in a cognitive interviewing. Each of the individuals met independently with the researcher and consent for participation was obtained. They were asked to read aloud the items from the research instrument and explain to the researcher what he or she thinks the item was asking. This process (read-aloud) was undertaken to ensure that each survey item was unambiguous, understandable and that what the respondent thought each question was asking matched the researcher's intent. Consent for participation was obtained. Based on participant feedback from cognitive interviewing, the majority of the questions read well, and only a few survey items were modified for language improvement.

The final step in developing the survey was to conduct a pilot test with six dental faculty members and sixteen residents from the Dental Radiology department who did not participate in the initial focus group nor in the cognitive interview. Using the encrypted and professional version of Survey Monkey, the survey was disseminated to identify item discrimination scores and ensure that items should remain. Following this analysis, all survey items were retained (figure 2).

The qualitative instrument consisted of an interview script and was initially written by the

Brazilian authors in Portuguese. To ensure its content, six Ad Hoc experts in Dental Radiology (3) and Education fields (3) analyzed the questions, that addressed the number of professors who teach radiology curriculum, their qualification and experience, course content and the reading material, teaching methodologies and other resources employed in teaching.

With the aid of input from the experts and after reaching consensus, the interview script was professionally translated into English, and pilot tested with four U.S. Dental Radiology faculty members. The interviews were audio recorded, transcribed and later analyzed by data saturation<sup>10-13</sup>. No changes were made (figure 3).

### 3 FINAL CONSIDERATIONS

This paper relies on the importance of describing the validation process for simultaneously using both qualitative and quantitative research instruments<sup>14-17</sup>.

While researching the literature, hardly any studies disclose or even mention the process that led to the development of the survey or investigation instrument that was used<sup>5-7,10,18,19</sup>. Often there is no mention in the articles about the use of these guidelines. Also, very few discuss the validation process and the steps taken<sup>20-29</sup>. Among the studies that do, very little information is given describing how the process was executed<sup>30-35</sup>. This occurs mainly in quantitative studies that utilize surveys, possibly because this design is more widely used and understood than qualitative instruments in health studies.

There were several steps in the validation process of the research instruments in this study, such as translation, cultural adaptation, expert evaluation, read-aloud sessions and pilot testing. This detailed process guaranteed control

**1. In how many courses across the four year dental curriculum are you teaching dental radiology content/topics? Please include all others besides the designated radiology courses.**

**2. Estimate how many hours across the entire dental school program this radiology content is taught.**

**3. In what year in the curriculum is the majority of pre-doctoral dental radiology taught? Select one answer that best reflects your response.**  
 1  
 2  
 3  
 4

**4. In pre-clinic and clinical activities, do students follow a biosafety protocol?**  
 Yes  
 No

**5. In pre-clinic and clinical activities, do students use X-ray film/sensor positioning system for periapical or bite-wing techniques?**  
 Yes  
 No

**6. In pre-clinic and clinical activities, do students follow an established written protocol to produce radiographs?**  
 Yes  
 No

**7. In pre-clinic and clinical activities, do students use mannequins to simulate techniques?**  
 Yes  
 No

**8. In pre-clinic and clinical activities, do students simulate techniques on classmates without exposure to X-rays?**  
 Yes  
 No

**9. Which of the following teaching methodologies are used by faculty? (Check all that apply):**  
 Problem based learning (case is presented to entire class and they come up with diagnosis in small groups or as individuals)  
 Distance learning  
 Lectures  
 Small group case based learning (case is presented in parts over three sessions to small cohorts of students, in which the group is facilitated by one faculty member.)

**10. Which of the following evaluation methods are used by faculty? (Check all that apply):**  
 Tests  
 Seminars  
 Discussion boards  
 Posing questions in the classroom or clinical learning environments

**11. Is there a dental radiology service for patients from outside the dental school at the university? If not, skip to question 13.**  
 Yes  
 No

**12. Who performs imaging procedures in the dental radiology service for patients from outside the dental school at the university?**  
 Dental students  
 Radiology technicians  
 Dental assistants  
 Other (please specify)

**13. Students who perform procedures in the dental radiology service for patients from outside the dental school are primarily:**  
 Predoctoral dental students  
 Dental graduate students  
 Radiology residents  
 Masters degree radiology students  
 PhD radiology students  
 Other (please specify)

**14. Identify the equipment used by dental students in radiology education. Check all that apply:**  
 Intra-oral equipment  
 Panoramic  
 CBCT  
 Computers for radiographic interpretation  
 Other (please specify)

**15. In addition to teaching predoctoral and graduate students, teachers in the area of radiology also teach in (check all that apply):**  
 Continuing education  
 Residency  
 Master's degree program  
 PhD program

**16. Course #1 Instructor: Please fill in the information as requested.**  
 Course #1 Title   
 Tenure (Indicate if Yes or No)   
 Age (Fill in number of years)   
 Time teaching (Fill in number of years)   
 Teaching position (Indicate if Full Time or Part Time)   
 Degree (Indicate which is most terminal degree: DMD, DDS, BDS or PhD)   
 Indicate if faculty member completed a residency in Radiology (Yes/No)   
 Indicate if faculty member earned a Masters degree (Yes/No)   
 Indicate if faculty member earned a PhD (Yes/No)   
 Indicate if faculty member is Board Certified by AAOBR (Yes/No)

**17. Course #2 Instructor: Please fill in the information as requested.**  
 Course #2 Title   
 Tenure (Indicate if Yes or No)   
 Age (Fill in number of years)   
 Time teaching (Fill in number of years)   
 Teaching position (Indicate if Full Time or Part Time)   
 Degree (Indicate which is most terminal degree: DMD, DDS, BDS or PhD)   
 Indicate if faculty member completed a residency in Radiology (Yes/No)   
 Indicate if faculty member earned a Masters degree (Yes/No)   
 Indicate if faculty member earned a PhD (Yes/No)   
 Indicate if faculty member is Board Certified by AAOBR (Yes/No)

**18. Course #3 Instructor: Please fill in the information as requested.**  
 Course #3 Title   
 Tenure (Indicate if Yes or No)   
 Age (Fill in number of years)   
 Time teaching (Fill in number of years)   
 Teaching position (Indicate if Full Time or Part Time)   
 Degree (Indicate which is most terminal degree: DMD, DDS, BDS or PhD)   
 Indicate if faculty member completed a residency in Radiology (Yes/No)   
 Indicate if faculty member earned a Masters degree (Yes/No)   
 Indicate if faculty member earned a PhD (Yes/No)   
 Indicate if faculty member is Board Certified by AAOBR (Yes/No)

**19. Please send the radiology class syllabus for any course that offers instruction about radiology (radiology courses and courses that include radiology content) to: [jenifferzc@yahoo.com.br](mailto:jenifferzc@yahoo.com.br)**

Figure 2. Validated survey form

<b>INTERVIEW SCRIPT</b>
<p>Part 1 - Data Training / manning / teaching function The institution where studied (graduation). In what year have he/she graduated? What is your academic background? How long have you taught? Disciplines? Semesters? Have an administrative role in the course or college?</p> <p>Part 2 - General questions "to teach college" For you what is to be a university teacher? What are the roles of the teacher? Are you involved in, or conducts research and extension activities at the university? # If yes: What are they? (interdisciplinary / inter-institutional). What is the workload? How are they developed? # If not: Is there any special reason for not participating?</p> <p>Part 3 - Issues on curricular "teaching / teaching radiology" Which model curriculum of your course? (modular, annual / semi-annual, per subject) You exert some educational function or is involved with the pedagogical design of the course? Did you participate in the development / implementation of the current curriculum model in your school? Are you satisfied or like to teach this model? # If yes: Why? What are the positives / strengths? # If not: Why? What are the negatives / weaknesses? What do you think should change? content, form) Are you satisfied with the contents? # If not: What would you like to teach? What do you think should stay in the undergraduate curriculum and the content that should be graduate? At what point or at what time the curriculum content is located in dental radiology? Do you think are appropriate? # If not: How do you think would be better? Are there separate lectures and preclinical or clinical activities specific for teaching the content of dental radiology practices? specify</p> <p>Part 4 - Questions " skills and abilities " for teaching dental radiology Taking into account the skills that should be part of the student's education (examples: healthcare, lifelong learning, decision making and communication), which you think are essential in the development of the discipline of radiology? Are pupils in patient care? (execution of techniques, radiographic examinations, delivery of reports). # If yes: They are trained / trained for this? How? Are students instructed / trained to indicate the techniques to be performed on these patients or are pre-established by the discipline? Check if the reported techniques are covered in the syllabus The students prepare diagnoses (or radiographic reports)? How? Which model of teaching radiographic techniques? Specify type(s). Which radiographic techniques are taught? In which radiographic techniques students must have skills (essential)? Are radioprotection protocols used? Which courseware is used as a reference discipline? Is the material produced by the discipline? What are the basic references to the subject? And further? The students are encouraged to read scientific articles, books or other supplementary materials to class? Are the students encouraged to read materials in other languages? What? The course works with seminars or resolution of cases (PBL)? The content of radiology is inserted into other disciplines? # If yes: What content - and what disciplines? Who provides radiologists are teachers? There is a philosophical conflict with other disciplines? The course offers training, boarding, training or technical training for diagnostic imaging? # If yes: For what audience? Is there any extension activity for students in radiology? (projects, programs, courses, service)</p> <p>Part 5 - Issues of assessment and perception of academic learning Monitoring or assessment of student learning at the end of the course that was taught in the subject (s) of radiology? # If yes: How? # If not: What is your opinion about it? In your opinion, the student after the course has appropriate skills in performing techniques and radiographic diagnosis?</p> <p>Part 6 - Issues - other issues (additional collaboration to the interview) Besides the issues discussed, you would like to make any additional comments?</p> <p>End of the interview, thank the participation and collaboration Note: Sending the plan of instruction at the end of the interview.</p>

Figure 3. Validated interview script

of the variables and also permitted that any bias was minimized in regard to the interview and the quantitative/qualitative method analysis.

#### RESUMO

##### Método de validação de instrumentos de pesquisa para estudo do currículo de Radiologia Odontológica

A Radiologia Odontológica é um conteúdo curricular importante para a graduação em Odontologia, pois juntamente com outras disciplinas desempenha um papel fundamental no diagnóstico, ponto de partida para o atendimento ao paciente. Desta forma, uma diretriz internacional específica para o currículo de Radiologia Odontológica foi publicada em 2007. O objetivo deste estudo foi desenvolver e validar dois instrumentos distintos, uma pesquisa online auto administrada e um roteiro de entrevista, ambos projetados para a pesquisa de educação em Radiologia Odontológica. Os processos de desenvolvimento e de validação dos instrumentos são descritos e os documentos finais são apresentados. Houve várias etapas no processo de validação dos instrumentos de pesquisa deste estudo, como tradução, adaptação cultural, avaliação de especialistas, sessões de leitura em voz alta e testes piloto. Esse processo detalhado garante o controle das variáveis e ajuda a evitar vieses em relação à entrevista e à análise do método quantitativo/qualitativo.

**Descritores:** Educação. Ensino. Radiologia. Odontologia. Pesquisa Qualitativa. Estudos de Validação. Entrevista.

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