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Curriculum Mapping: An Essential Tool for Radiologic Science Education

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Objectives

- Evaluate curriculum and curriculum mapping, specifically as related to radiologic science education.
- Identify and explain the driving forces behind curricular changes within radiologic sciences and implications to practice.
- Evaluate curriculum mapping components and stages along with roadblocks to adoption.
- Review curriculum mapping templates and discuss utilization.

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What Should be Taught First?

- Digital image characteristics, pixels, matrix...
- OR
- Image formation, image enhancement processing

----------------------------------------

- Standard terminology for positioning and projection
- OR
- Positioning for pelvis
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What is curriculum?

- Latin origins of the word “curriculum” identify a race course.
- Loosely translated to mean "the course, the path, the road."
- Refers to a highway or pathway of growth and development.

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What is curriculum?

- Formal academic experience of a students’ pursuit;
- Road map of planned experiences provided to learners by the instructors;
- Educational plan of the institution, school, college, department, program or course

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What is curriculum?

- Sophisticated blend of educational strategies, course content, learning outcomes, educational experiences, assessment, the educational environment and the individual students’ learning style, personal timetable and program of work.
- Program of study where the whole is greater than the sum of the individuals parts.

- R.M. Harden — Centre for Medical Education and Education Development Unit, Dundee, UK.
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**Curriculum Focus**
- Curriculum design
- Curriculum practice


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**Curriculum Design**
- What, where, when, why, and who of student learning.
  - Who—in this context is not a teacher; it is a course.
- Elements
  - Standards (JRCERT adopted)
  - Unit, content, skills, assessment/evaluations

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**Curriculum Practice**
- Teachers or teachers' choice for how to best deliver the instruction to ensure learning as well as measuring and evaluating the learning acquisition.
- Elements
  - Assessments/evaluations (design and practice), resources (books), activities/strategies
Radiologic Sciences/Technology Curriculum

- Goal
  - Identify a common body of knowledge essential for entry-level technologists.
  - Adherence to a curriculum helps to ensure technologists possess the necessary technical skills.

Radiologic Technology Curriculum

- Radiography Curriculum
  - American Society of Radiologic Technologists (ASRT)

Radiography Curriculum-ASRT

- Produced by ASRT Radiography Curriculum Revision Project Group
  - Goal has been to outline a common body of knowledge that is essential for entry-level radiographers.
  - Serves as a blueprint for educators to follow in designing their programs and in ensuring that their programs match the profession's standards.
Radiography Curriculum - Content & Objectives

- Clinical Practice
- Digital Image Acquisition and Display
- Ethics and Law in the Radiologic Sciences
- Human Structure and Function
- Image Analysis
- Imaging Equipment
- Introduction to Computed Tomography
- Introduction to Radiologic Science and Health Care
- Medical Terminology
- Patient Care in Radiologic Sciences
- Pharmacology and Venipuncture
- Principles of Imaging
- Radiation Biology
- Radiation Production and Characteristics
- Radiation Protection
- Radiographic Pathology
- Radiography Procedures
- Radiation Protection
- Radiographic Procedures
- Required General Education

Who Controls the Curriculum in Radiologic Technology?

- Certifying Agency
- Accrediting Agency
- Professional Organization
- Other

Radiologic Technology Curriculum

- Numerous technological and educational advancements.
- In light of dynamic advancements it is imperative that the educational curriculum reflects current practice and that educators have a firm grasp on the depth and breadth of material and its' relevance.

- As profession evolves so must curriculum.
Curriculum Organization

- Radiography programs take the appropriate curriculum and organize the content and scaffolding in support of student learning.

Curriculum Development

- Has become increasingly more difficult to manage in part due to:
  - Increased medical/technical knowledge
  - Clinical skills expected
  - Proliferation of educational strategies
  - Student centered learning
  - Evidence based

Curriculum Development

- How do curriculum developers communicate about the content of curriculum and track content?
- How do faculty know what has been covered in the curriculum...and when it has been addressed...and at what level?
- How does assessment relate to the curriculum?
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Curricular Plan

- Designing, preparing and implementing a curriculum necessitates a comprehensive plan with a focus on alignment and evaluation.

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Curriculum Mapping

- Aspect of curriculum development
  - Curriculum mapping is one method that can be used to keep the curriculum dynamic in an age of changes and provides a visual representation of the curriculum.
  - Provides a context for planning and discussing the curriculum so that decisions are not made in a vacuum.
  - Tracks what is taught, how it is taught, and when it is taught.

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Curriculum Mapping

- What is taught
  - Content, areas of expertise addressed, learning... outcomes

- How it is taught
  - Learning resources, learning opportunities...

- When it is taught
  - Timetable, curriculum sequence...

- Measures used to determine whether the student has achieved the expected learning outcomes
  - Assessment
Introduction of Curriculum Mapping

- Concept of curriculum mapping originated in the 1980s with the work of Fenwick English.
- ...was to give a broad picture of the taught curriculum.

Curriculum Map
- Assembles Pieces of Curriculum Together

Why a Curriculum Map?
- Makes the curriculum more transparent to all the stakeholders:
  - Teacher, student, curriculum developers, manager/director, profession, public.....
- Demonstrates the links between the different elements of the curriculum:
  - Between learning outcomes and learning opportunities and between the parts within one element;
  - Between different learning outcomes.
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**English (1978) Fictional Curriculum**

- Taught
  - Real
  - Curriculum as it is delivered/presented to the student
- Declared
  - What is assumed the student are learning
- Learned
  - What students actually learn

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**Types of Curriculum**

- Taught
  - Real
  - Curriculum as it is delivered/presented to the student
- Declared
  - What is assumed the student are learning
- Learned
  - What students actually learn

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**Map**

- Road map
  - Determine how near or far towns
  - Determine road connections, topography, obstacles
- Curriculum map
  - Determine different aspects of the curriculum
  - Determines relationships and nature of connections
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Curriculum Map

- Allows/supports development of integrated curriculum;
- Can be used to ensure coherence across the integrated curriculum;
- Allows for a reconceptualization of the subject matter in a way that eliminates redundancy, creates a smooth transition between courses, and demonstrates the conceptual interrelationships the faculty hope students will develop as a result of integrated, meaningful learning. (Edmondson, 1993)

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Curriculum Map Lenses

- Wide variety of lenses in which to develop curriculum map:
- Expected learning outcomes
- Curriculum content
- Student assessment
- Learning opportunities
- Learning location
- Learning resources
- Timetable
- Staff
- Curriculum management
- Students

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Curriculum Map Development Process

- Access needs
- Scope the task
- Essence
- Content
- Format of the map
- Inclusion—past, present and future
- Access to map
- Assessment and evaluation
- Responsible party
Process of Curriculum Mapping

- Develop individual maps for each course;
- Review and aggregate maps (horizontally) by course;
- Aggregate the maps (horizontally) by course;
- Group identifies strengths, gaps, overlaps, etc;
- Revise course and implement revisions;
- Repeat the process


Curriculum Mapping

- Electronic
  - Computer-based
  - Filemaker Pro
  - Microsoft Access
  - Microsoft Excel
- In-house

Commercially Available Curriculum Mapping Programs

- Rubicon Atlas
- Curriculum Compass
- Curriculum Mapper
- SemNet (Macintosh-based system)
Curriculum Mapping/Assessment Management Software

- Tools to map curriculum, define outcomes/goals, collect and store assessment data, store other documents (student work), generate reports based on assessment results:
  - TK20
  - TracDat
  - WEAVEonline
  - LiveText

JRCERT Radiography Curriculum Analysis

- Identifies the course(s) which correlate with ASRT curriculum content areas.

Curriculum Analysis Grid - Radiography (2012)

Radiography Curriculum Analysis
JRCERT
Radiation Biology

<table>
<thead>
<tr>
<th>Professional Competencies</th>
<th>Program Competencies</th>
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<tbody>
<tr>
<td>Introduction</td>
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<tr>
<td>Molecule</td>
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<td>Basic cellular biology</td>
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<td>Types of ionizing radiation</td>
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<td>Radiation Energy Transfer</td>
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<td>Radiation Effects</td>
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<td>Radiosensitivity and Response</td>
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ASRT
Program Planning Worksheets
- Global Planning Matrix
- Excel template allows for mapping content topics, objectives, and academic semesters (editing capabilities)
  - Individual semesters can be identified as lecture week (1-15)
  - Notation key (I=Introduce; R=Reinforce; M=Mastery)
- https://www.asrt.org/educators/education-tools/program-administration-tools
- Program Planning Worksheets
  - Select template

Program Planning Matrix
<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
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Curriculum Objectives Matrix

ASRT

<table>
<thead>
<tr>
<th>Description</th>
<th>ASRT</th>
<th>I</th>
<th>R</th>
<th>M</th>
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<tbody>
<tr>
<td>Describe the characteristics of a molecule.</td>
<td>RT101</td>
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<tr>
<td>Identify specific physical and chemical properties.</td>
<td>RT102</td>
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<td></td>
<td></td>
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<tr>
<td>Identify reasons for the use of radiography and radiation therapy.</td>
<td>RT103</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Discuss the benefits and risks of radiography and radiation therapy.</td>
<td>RT104</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Identify the types of radiation exposure.</td>
<td>RT105</td>
<td></td>
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</tr>
<tr>
<td>Identify sources of radiation exposure.</td>
<td></td>
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<tr>
<td>Discuss radiation-induced chemical reactions and potential biologic damage.</td>
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<tr>
<td>Evaluate factors influencing radiobiologic and subcellular level.</td>
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</tbody>
</table>

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In-House Curriculum Map Sample

- Using ASRT Curriculum
- Content areas
- Mapped content area topic
  - Course
    - Academic term (f=fall; s=spring; ss=summer)
  - Delivery (lec=lecture; lab=lab; online/hybrid)
  - Domain (c=cognitive; p=psychomotor; a=affective)
  - Depth (f=foundational/knowledge & comprehension; m=moderate/application & analysis; h=high/synthesis & evaluation)
  - Objective (y=yes; n=no)
  - Measure (t=printed test; ot=online test; ls=lab activity sheet; ws=worksheet)

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Exposure Factor Formulation

<table>
<thead>
<tr>
<th>Student</th>
<th>Course</th>
<th>Term</th>
<th>Del.</th>
<th>Dom.</th>
<th>Depth</th>
<th>Obj.</th>
<th>Measure</th>
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</thead>
<tbody>
<tr>
<td>Student 1</td>
<td>Exposure-incident exposure standardization</td>
<td>Fall</td>
<td>lec</td>
<td>c</td>
<td>f</td>
<td>y</td>
<td>t, ls</td>
</tr>
<tr>
<td>Student 2</td>
<td>Exposure-management</td>
<td>Spring</td>
<td>lab</td>
<td>p</td>
<td>m</td>
<td>y</td>
<td>ot, ws</td>
</tr>
<tr>
<td>Student 3</td>
<td>Calculated-incident dose absorbed tissue system</td>
<td>Summer</td>
<td>online</td>
<td>a</td>
<td>h</td>
<td>n</td>
<td>ls</td>
</tr>
<tr>
<td>Student 4</td>
<td>Calculated-dose to patient/technician</td>
<td>Fall</td>
<td>lec</td>
<td>c</td>
<td>f</td>
<td>y</td>
<td>t, ls</td>
</tr>
<tr>
<td>Student 5</td>
<td>Calculated-image processing</td>
<td>Spring</td>
<td>lab</td>
<td>p</td>
<td>m</td>
<td>y</td>
<td>ot, ws</td>
</tr>
<tr>
<td>Student 6</td>
<td>Radiographic technique</td>
<td>Summer</td>
<td>online</td>
<td>a</td>
<td>h</td>
<td>n</td>
<td>ls</td>
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<tr>
<td>Student 7</td>
<td>Patient's body mass</td>
<td>Fall</td>
<td>lec</td>
<td>c</td>
<td>f</td>
<td>y</td>
<td>t, ls</td>
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<tr>
<td>Student 8</td>
<td>Patient's body density</td>
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<td>lab</td>
<td>p</td>
<td>m</td>
<td>y</td>
<td>ot, ws</td>
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<tr>
<td>Student 9</td>
<td>Patient's contrast medium</td>
<td>Summer</td>
<td>online</td>
<td>a</td>
<td>h</td>
<td>n</td>
<td>ls</td>
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</tbody>
</table>
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**Curriculum Mapping Rationale**

- Dynamic technological and educational advancements
- Complexity of curriculum
- Alignment and articulation of curriculum
- Vertical and horizontal integration
- Range of teaching and learning tools
- Transparency and accessibility of curriculum
- Improved communication
- Congruency of curriculum with expected learning outcomes

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**Curriculum Mapping Benefits**

- Foster collaboration and collegiality
- Faculty engagement
- Updating disciplinary knowledge
- Meeting students’ needs
- Decreases isolation
- Promotion of supportive culture that enhances learning of all stakeholders

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**Roadblocks**

- Administration
- Faculty
- Time and effort
- Lack of collegiality and collaboration
- Threats—possibly due to perceived complexity
- Status quo
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Curriculum Mapping

Ongoing

Dynamic Process

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There is nothing wrong with change, if it is in the right direction.

Winston Churchill

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Dr. Sarah S. Baker

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