

Table 4

Learning and Measurable Objectives by Construct Set for the Course Objective *Manipulate Clinical Data Using SQL—Access, Validate, and Integrate Clinical Data into a RDBMS (Data Manipulation Language)*

Learning Objectives	Set	Example Measures (Quadrant[s] for ECS)
SELECT/FROM/WHERE statements	MCS	- Single-table select - Filtering single-table results
Operators		
- Unary and ranges	MCS	- Filter data using simple comparison - Filter data using ranges
- Regular expressions	MCS	- Filter via regular expressions
Set operations		
- Basic: IN, NULL, DISTINCT, LIMIT	MCS	- Return distinct values - Limiting results - Filter data based on null values - Filter data based on another set
- Advanced: EXISTS, UNION, INTERSECT, EXCEPT	ECS	- Filter data based on attribute value existence (TN/TT) - UNION/INTERSECT/EXCEPT multiple sets (TT)
Aggregate Functions		
- Full sets	MCS	- Aggregate full set
- Subsets (GROUP BY/HAVING)	MCS	- Aggregate subset, necessitating the GROUP BY clause - Filter aggregate using the HAVING clause
Joins		
- Inner, natural, and Cartesian	MCS	- Inner/natural join to produce relational results - Understand Cartesian join as a way to identify missed join predicates (simply an error recognition tool in MCS)
- Outer and semi	ECS	- Outer joins for merging/converting data sets (TN/TT) - Semi-joins for data transmission over a network during the execution process (TT)
Sub-queries		
- Non-correlated	MCS	- Provide answer for a noncorrelated subquery
- Correlated	ECS	- Provide answer for a correlated subquery (TT) - Convert correlated subquery to statement/view structure (TT)

		- Rewrite correlated subquery (if possible) as a noncorrelated statement (TT)
Parentheses and SQL order of execution	MCS	- Appropriate use of parentheses to ensure correct logical order of predicate execution (e.g., Boolean parenthetical problem)
Creating tables via queries	MCS	- Create a table from the result of a query
Inserting, updating, and deleting tuples		
- Individual statements	MCS	- Insert, update, and delete tuples using single statements
- Via queries	MCS	- Insert, update, and delete tuples using SELECT results
Views		
- Basic views	MCS	- Integrate view(s) into a query - Use of view as inline-select and subquery replacement
- Temporary, updatable, and materialized	ECS	- Use a temporary (scoped) view (TT) - Update data via an updatable view (TT) - Use and refresh materialized views (TT)

Abbreviations: ECS, extended construct set; MCS, minimum construct set; N, nontechnical; RDBMS, relational database management system; T, technical.

Notes: Quadrants listed for each ECS measure are defined in Table 1 and would be measured by a combination of the student survey and students' progress. The ECS and MCS for the objective in this example are in Tables 7 and 8 of the following source (the previous article in this series).

Source: Hylock, Ray, and Susie T. Harris. "Healthcare Database Management for Health Informatics and Information Management Students: Challenges and Instruction Strategies—Part 1." *Educational Perspectives in Health Informatics and Information Management* (Winter 2016): 1–24.