**SQL vs NoSQL (MongoDB) – Comparison for ResearchNest**

| **Aspect** | **SQL** | **NoSQL (MongoDB)** | **Winner** |
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| **Dashboard Data (Get full student progress tree)** | Requires multiple JOINs across milestones, stages, tasks, and subtasks. Slower with deep hierarchies. | Single findOne() fetches the entire embedded tree instantly. Extremely fast. | **MongoDB** |
| **Granular Updates (Update a single subtask)** | Simple UPDATE on one row. Very efficient with indexing. | Needs array filters and positional operators to traverse nested arrays. More complex and slower. | **SQL** |
| **Faculty-Specific Queries (Get students by department)** | Efficient with JOINs, flexible for many-to-many mappings. | Works with indexed queries (find({ role, department })), but less flexible for complex relations. | **SQL** |
| **Transactions & Data Integrity** | Strong ACID transactions across multiple entities. Cascade deletes (ON DELETE CASCADE) handled automatically. | Atomic only within a single document. Cross-document consistency needs extra code. | **SQL** |
| **Ease of Data Embedding** | Normalized structure requires multiple tables and relations. | Natural embedding of milestones, stages, tasks, and subtasks in a single document. | **MongoDB** |
| **Scalability** | Vertical scaling (bigger servers). Relational joins become heavier with scale. | Horizontal scaling (sharding). Read-heavy workloads (like dashboards) benefit. | **MongoDB** |
| **Learning Curve & Query Simplicity** | Mature, standardized SQL queries. Well-suited for relational operations. | Flexible schema, but nested updates and queries can be tricky. | Depends on use case |

**Final Verdict**

* **MongoDB** → Best for **fast reads** like student dashboards.
* **SQL** → Superior for **updates, complex queries, data integrity, and faculty workflows**.
* **Recommendation** → Use **SQL** as the core database for ResearchNest due to heavy relational needs, with optional caching/replication strategies for read-heavy endpoints.