There is little research to be found related to the development of Algorithmic Thinking ...

... findings in Computer Science and Computer Education concerned older students and focussed on programming.

By contrast, in the field of mathematical education in general, and the psychology of mathematical education in particular, there is a wealth of research and accepted theories developed over many years (Costello, Teaching and Learning Mathematics 11-16).

**Research findings in Mathematics**

  - wrong answers from inappropriate strategies, sometimes invented
  - maths is difficult, huge range of attainment amongst pupils of the same age

- **Assessment of Performance Unit (1977-82)**
  - development of an assessment framework based on concepts, skills and application dividing mathematics into topics - basis for National Curriculum
  - answered the question - “what percentage of students at what age have accurate understanding”

**What thinking?**

- **facts** recall of terms, simple relationships
- **skills** standard well-established procedures
- **conceptual structures** complex and dynamic relationships, mental models
- **problem solving strategies** analysis, creativity, execution
- **attitudes** determination, motivation, love of subject, concern for quality & detail
Algorithmic Thinking

An algorithm can be defined as a collection of unambiguous executable instructions, whose step by step execution leads to a predefined goal, within a finite number of steps.

Algorithmic thinking occurs in the development of algorithms.

Algorithmic Thinking is a complex intellectual process of thinking, combining facts, skills, etc.

Nili’s Conceptual framework

Teaching & Learning Strategies

Thinking & Problem Solving

Algorithmic Thinking

Algorithms

Nili’s findings

Perception that all terms in a data structure are of the same type
Questions:

1. What other research is there into computing thinking, whether about algorithmic thinking, data structures or programs - facts, skills, conceptual structures, problem solving strategies or attitudes?
2. How can learners benefit?
3. How can practitioners contribute, in the modern age of online collaboration?