

# Programming misconceptions and other errors

## Conceptual knowledge category

Misconceptions in this category are ordered from the least to the most frequent according to the frequencies from primary school participants.

no.	Misconceptions and other errors	References	Tasks that challenge misconceptions
1	Difficulties in distinguishing between different data types.	NEW	3.
2	Several lines of a program can be simultaneously active.	(Pea, 1986), (du Boulay, 1986), (Swidan & Hermans, 2018)	1.
3	Difficulties in understanding conditional statements with the relational operator or other math expressions included.	(Gobil, Shukor, & Mohtar, 2009)	14.
4	The computer is able to deduce the intention of the programmer. The system does not allow unreasonable operations.	(Pea, 1986), (Ragonis & Ben-Ari, 2005)	2.
5	Difficulties in understanding loops – exactly how many iterations get executed.	(Sleeman, Putnam, Baxter, & Kuspa, 1986)	14., 19., 20., 24.
6	'While' loops terminate as soon as the condition changes to false.	(du Boulay, 1986), (Pea, 1986), (Swidan & Hermans, 2018)	19.
7	Difficulties in understanding when the loop terminates execution. Students are struggling with construct - 'Repeat until condition'.	(Grover & Basu, 2017)	19., 20., 24.
8	Code in the sub and main program is executed sequential - calls are ignored.	NEW	23.
9	A variable can hold multiple values at the same time. Remembers old values. Remembers the sum of values.	(Doukakis, Grigoriadou, & Tsaganou, 2007), (Sleeman, Putnam, Baxter, & Kuspa, 1986), (Swidan & Hermans, 2018)	4.
10	Using 'else' is optional.	(Sleeman, Putnam, Baxter, & Kuspa, 1986)	11.
11	Difficulties in understanding the incremental counter variable (Improper update of loop counter).	(Grover & Basu, 2017)	19., 20.
12	Subprogram code is executed according to the order in which the subprograms are defined.	(Ragonis & Ben-Ari, 2005) (Sleeman, Putnam, Baxter, & Kuspa, 1986)	24.
13	Code in the loop body is always executed in its entirety.	NEW	21.
14	Adding negative numbers error.	NEW	16.
15	The natural-language semantics of variable names affects which value is assigned to which variable.	(Kaczmarczyk, Petrick, East, & Herman, 2010) (Sleeman, Putnam, Baxter, & Kuspa, 1986)	7.
16	Primitive assignment works in the opposite direction.	(du Boulay, 1986), (Sirkia & Sorva, 2012), (Swidan & Hermans, 2018), (Sleeman, Putnam, Baxter, & Kuspa, 1986)	5., 6.
17	Replacing comparison operator (==) with assignment operator (=).	NEW	5., 7.
18	Loops' output data is the same on every iteration.	(Grover & Basu, 2017)	19., 20.
19	A variable name is always short. Long names are mistaken for a line of code.	(Grover & Basu, 2017)	8.

20	Construct of 'while' loop is better than 'for' loop or vice versa. Students believe that while loop is better because their skills with implementing 'while' loops are better.	(Sleeman, Putnam, Baxter, & Kuspa, 1986)	21.
21	Both 'then' and 'else', branches are executed.	(Sleeman, Putnam, Baxter, & Kuspa, 1986)	10.
22	Difficulties in understanding automated changes to 'for' loop control variables.	(Sleeman, Putnam, Baxter, & Kuspa, 1986)	22.
23	Code segments execute from state null.	NEW	17., 18.
24	Else' branch is always after 'then' branch.	(Sleeman, Putnam, Baxter, & Kuspa, 1986)	11., 12.
25	Grouping of code.	(Grover & Basu, 2017)	17., 18.
26	Each line of code is executed at least once.	(Sorva, 2008)	several tasks
27	A value of a source variable is changed to 0.	(Sorva, 2018)	5.
28	Code in the 'then' branch gets executed whenever a condition is true, even if control is not in the 'then' branch.	(Sorva, 2018)	15.
29	'Neighborhood code' gets executed inside a loop.	(Sirkiä & Sorva, 2012), (Swidan & Hermans, 2018)	19., 20.
30	The code in the 'then' branch is always executed.	(Sleeman, Putnam, Baxter, & Kuspa, 1986)	12.
31	Primitive assignment stores equations or unresolved expressions.	(Bayman & Mayer, 1983) (Putnam, Sleeman, Baxter, & Kuspa, 1986)	9.
32	A false condition ends the program if no 'else' branch.	(Sleeman, Putnam, Baxter, & Kuspa, 1986)	12.
33	Difficulties in distinguishing between OR and XOR.	(Sleeman, Putnam, Baxter, & Kuspa, 1986)	13.
34	Control goes back to start when the condition is false.	(Sleeman, Putnam, Baxter, & Kuspa, 1986), (Swidan & Hermans, 2018)	12.
35	EXCLUDED - A variable is merely a pairing of a name to a changeable value. It is not stored inside the computer.		6.

### Strategic knowledge category

no.	Misconceptions and other errors	References	Tasks that challenge misconceptions
36	Difficulties with applying variables 'count' and 'sum'.	(Sajaniemi & Prieto, 2005), (Simon, 2013)	25.
37	Difficulties in distinguishing between simplicity and efficiency of code.	NEW	26.
38	Difficulties with debugging (errors are labelled; independent programming constructs).	(Fitzgerald, in drugi, 2008), (McCauley, in drugi, 2008)	27.
39	Difficulties with with problem decomposition.	(Muller, 2005), (Robins, Haden, & Garner, 2006)	29.
40	EXCLUDED - Difficulties with planning a complete solution (reusing code, combining code blocks)	(Ginat, Menashe, & Taya, 2013)	30.
41	Difficulties with debugging (errors are not labelled; nested programming constructs)	(Fitzgerald, in drugi, 2008), (McCauley, in drugi, 2008)	28.
42	EXCLUDED - Difficulties with choosing the appropriate programming concept for a particular problem.	(de Raadt, 2008)	30.