

```

124
125 private void exitForm(java.awt.event.WindowEvent evt) {
126     System.exit (0);
127 }
128
129 /** Starts the application.
130  * @param args Application arguments.
131  */
132 public static void main(String args[]) {
133
134     /**
135     private static class ImageFileFilter extends javax.swing.filechooser
136     public static void main (String args[]) {
137
138     public boolean accept (java.io.File file) {
139         if (file == null)
140             return false;
141         return file.isDirectory() || file.getName().toLowerCase().e
142     }
143     return file.isDirectory() || file.getName().toLowerCase().e
144     }
145     }
146     public String getDescription() {
147     }
148     }
149     }
150     }
151

```

HOW TO IMPROVE PROGRAMMING FOR NOVICES?

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PROBLEMS WITH PROGRAMMING STUDIES

- ❑ Students struggle to learn programming.
- ❑ Dramatic drop in the number of students enrolling in IT and Computer Science courses.
- ❑ The attrition continues to be significant.
- ❑ Introductory programming subjects traditionally have high failure rates.

IN A SURVEY OF FAILURE RATES FOR INTRODUCTORY PROGRAMMING COURSES

- ❑ The average failure rate in the introductory programming course [Bennedsen et al. 2007] * :
 - ❖ at universities in the U.S. → 33%
 - ❖ at universities outside the U.S. → 41%
 - ❖ quite a few major European universities reported failure rates of more than 50%

* J.Bennedsen et al.: "Failure Rates in Introductory Programming", SIGCSE Bull, Vol. 39, No.2, 2007.
(<http://cs.au.dk/~mec/publications/journal/25--bulletin2007.pdf>)

IT CAN BE A ROAD BLOCK FOR MANY STUDENTS TO CONTINUE THEIR UNIVERSITY STUDIES!!!

IS IT REALLY DIFFICULT TO LEARN PROGRAMMING?

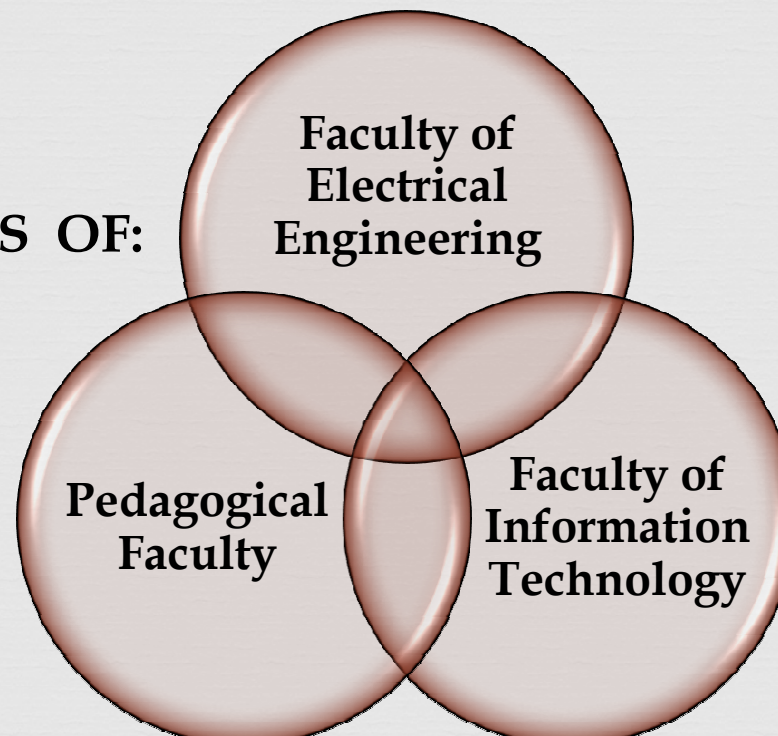
WHAT STUDENTS, AS FUTURE PROFESSIONAL PROGRAMMERS, THINK ABOUT THAT?

RESEARCH

The participants in our study (February 2013) were students of :

- ❑ the Faculty of Electrical Engineering - Computer Science Department,
- ❑ the Faculty of Information Technology,
- ❑ the Pedagogical Faculty - Department of Mathematics and Informatics.

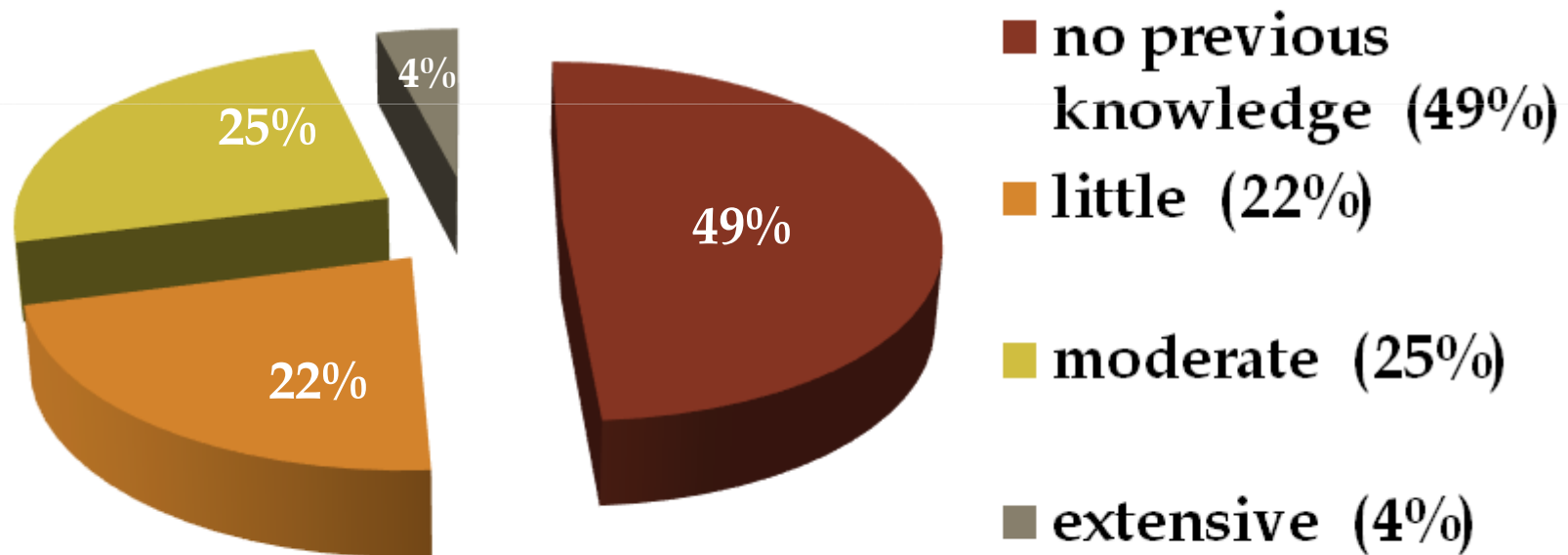
STUDENTS OF:



The survey was conducted in February 2013, after the semester in which students attended an introductory course in programming.

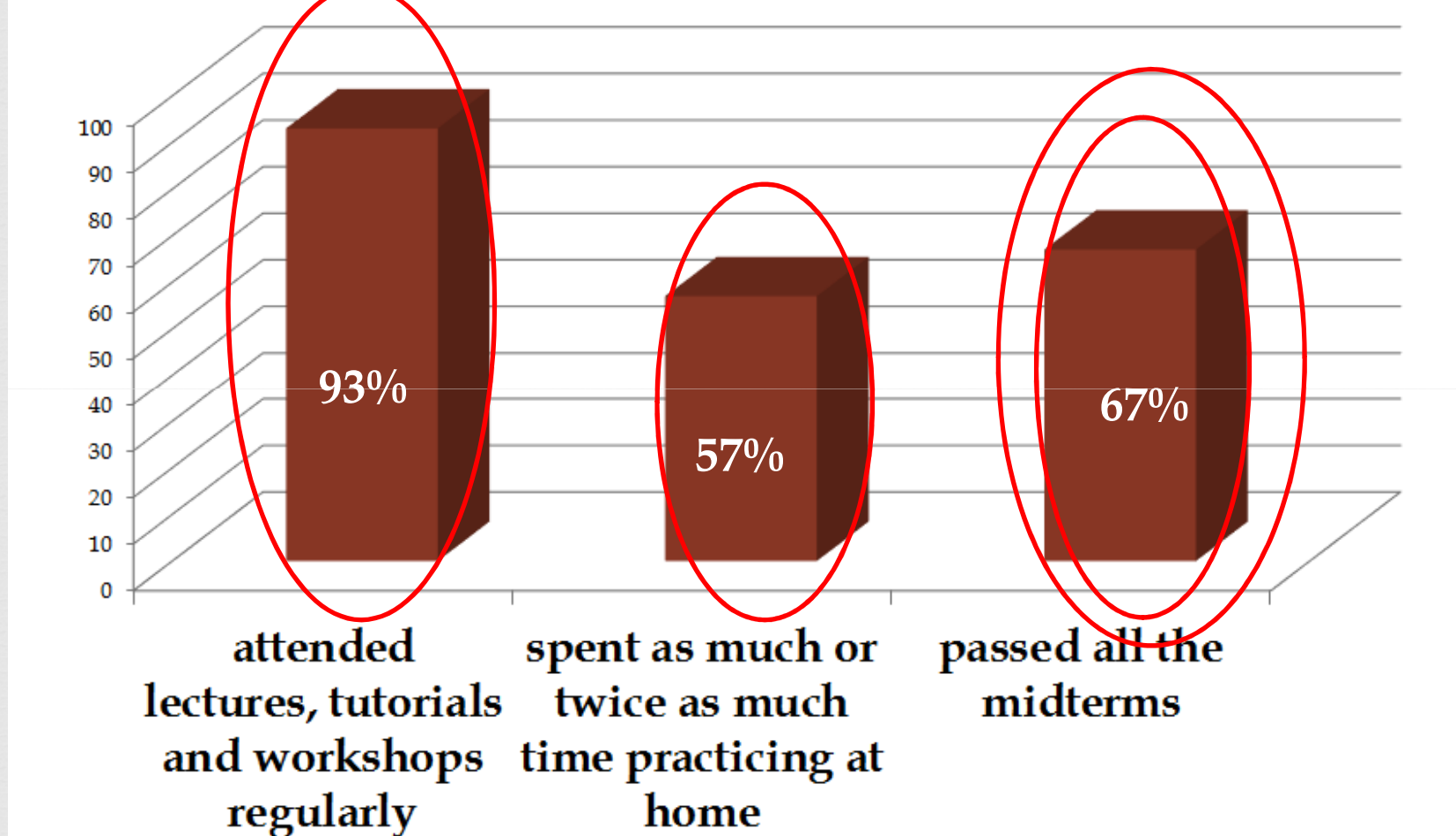
From all the students who participated in the survey

Knowledge of programming language



The survey' results

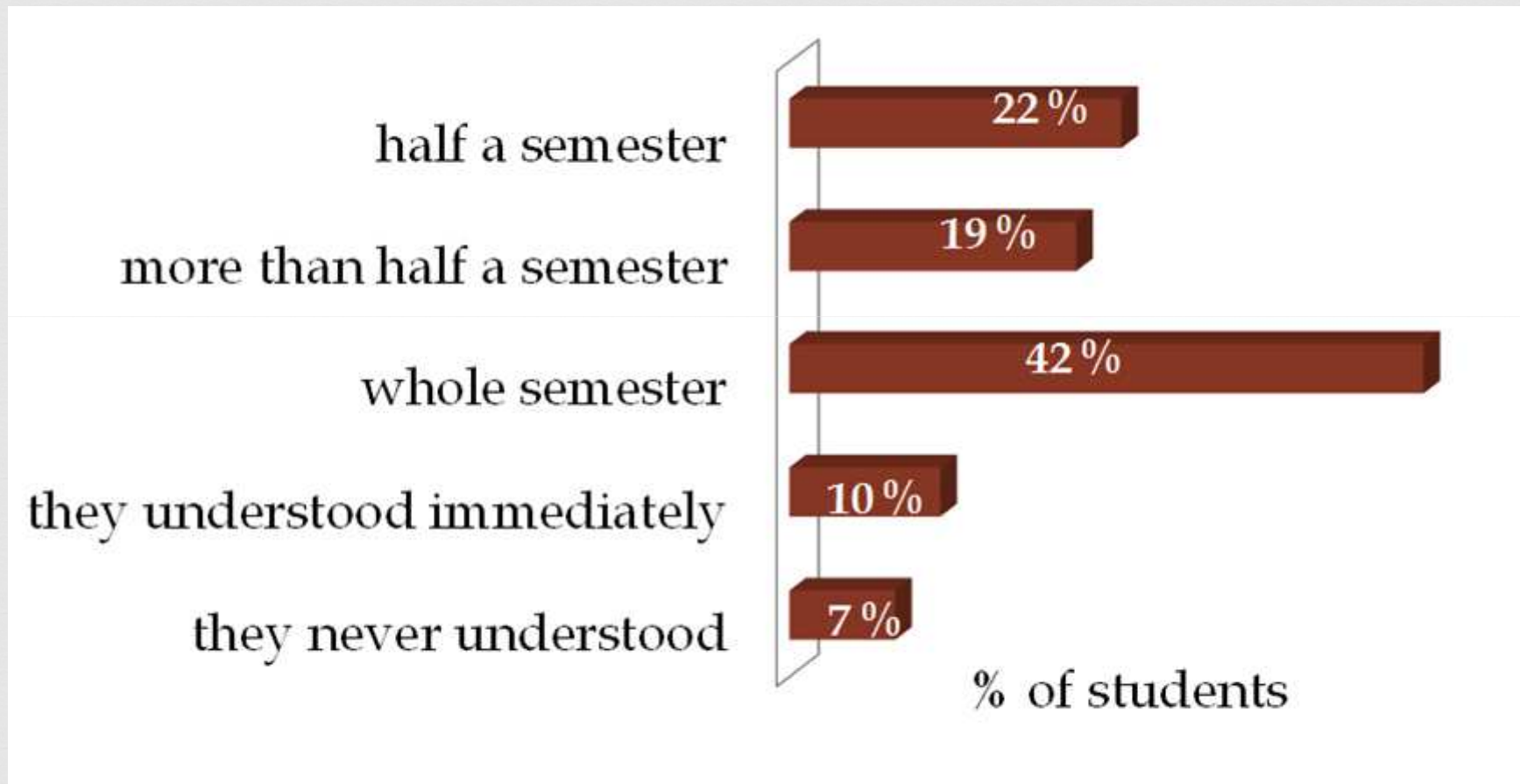
(students' involvement and midterm test achievement)



THE PROGRAMMING IS DIFFICULT FOR BEGINNERS.

The survey' results

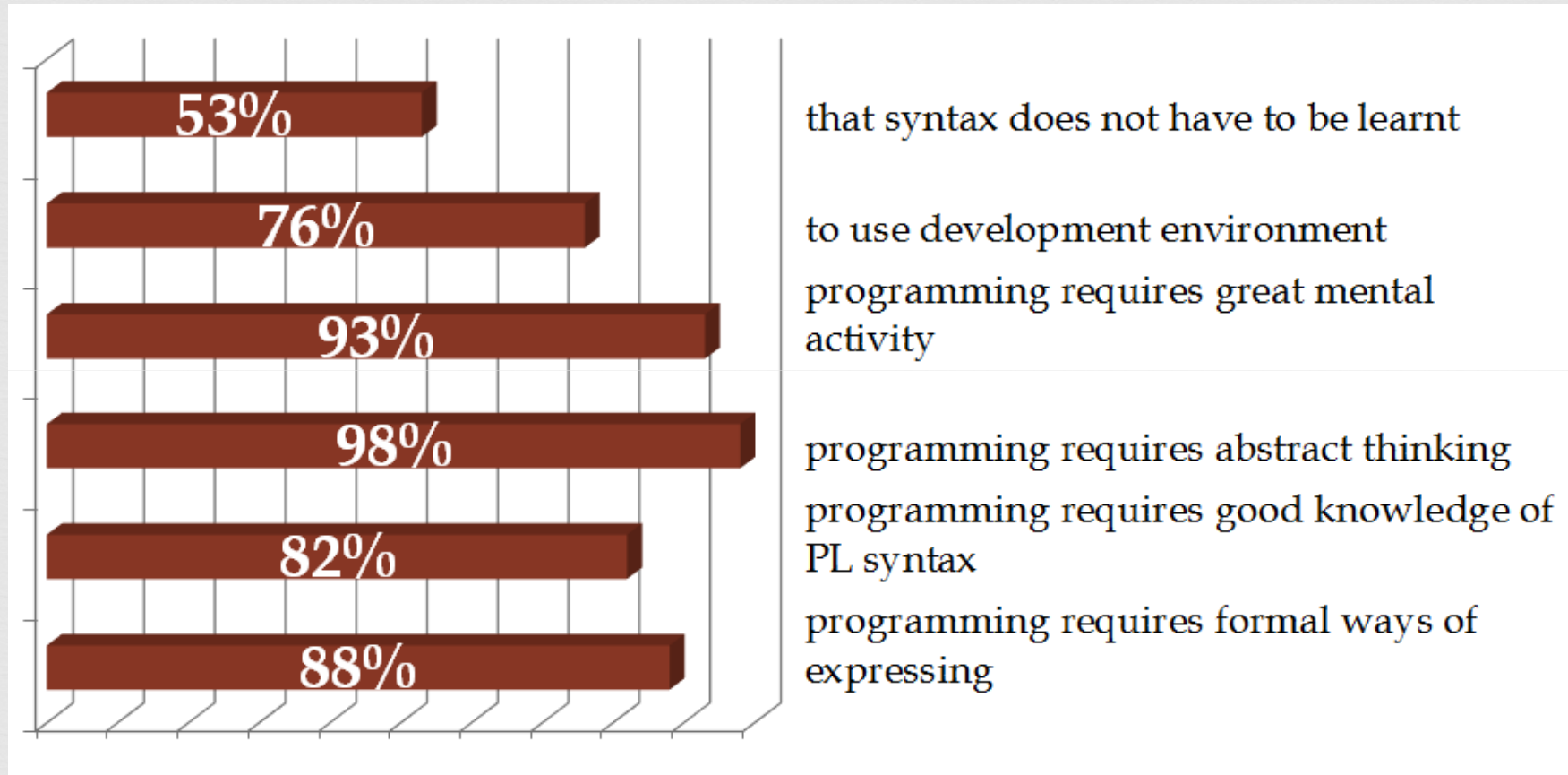
Period of time to master programming - to acquire the abstraction inherent to programming



**THE PROGRAMMING IS ABSTRACT.
THE ABSTRACTION IS DIFFICULT TO UNDERSTAND.**

The survey' results

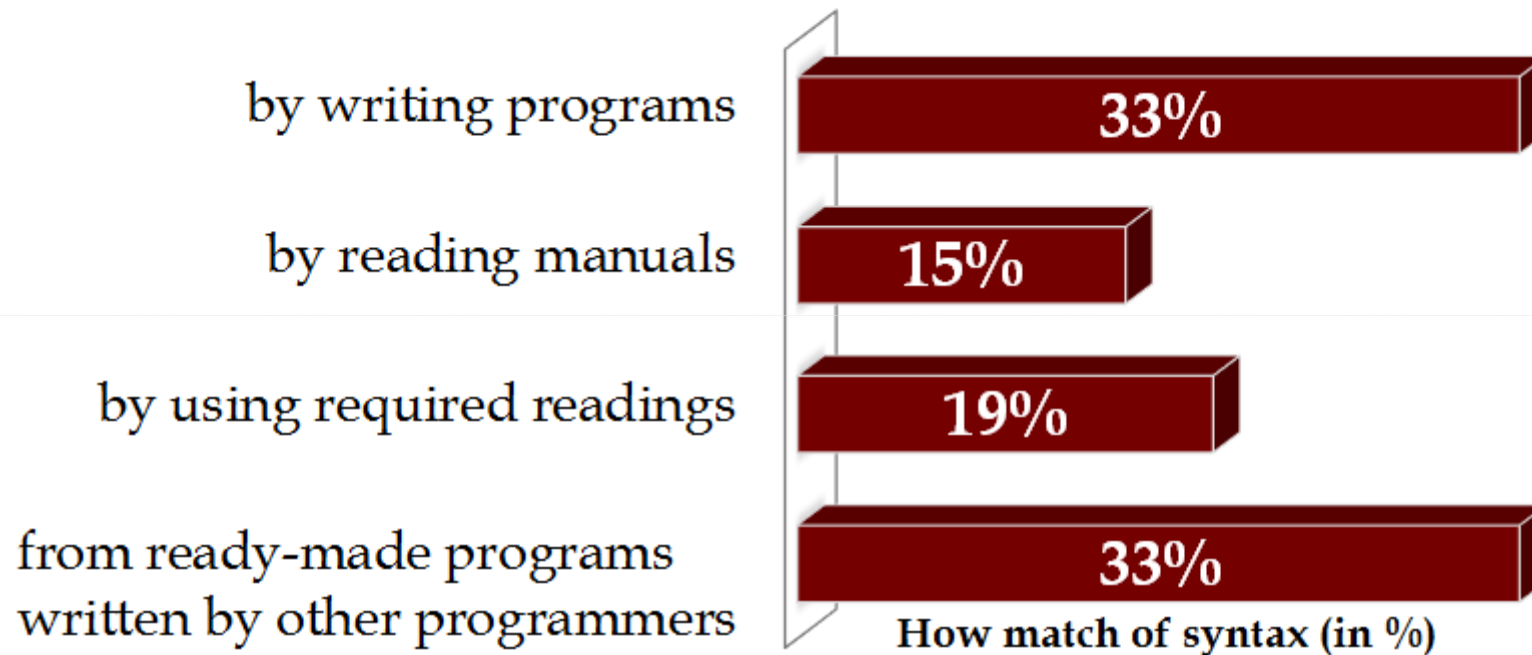
(about syntax, development environment and programming)



THE PROGRAMMING IS DIFFICULT FOR BEGINNERS.

The survey' results (mastered syntax)

The students have mastered 69% of syntax on average, and so :



63% of students confirmed that they would sometimes spend up to half an hour to detect common syntax errors.

78% of students agreed that the programming tools & technology should be valued based on their strengths and opportunities, user-friendliness and ease of use.

To prove the thesis that programming is a difficult and challenging activity, despite regular attendance at lectures, tutorials and workshops, we used a statistical method of Chi-square test.

Two groups of theses :

Group I

Hypothesis 1 (H1): Students who attend the lectures/ tutorials/ workshops regularly are able to pass the exam.

Hypothesis 2 (H2): Students who attend the lectures/ tutorials/ workshops regularly are still not able to pass the exam.

Group II

Hypothesis 3 (H3): Students who attend the lectures/ tutorials/ workshops occasionally are able to pass the exam.

Hypothesis 4 (H4): Students who attend the lectures/ tutorials/ workshops occasionally are not able to pass the exam.

Group I : **Hypothesis 1 (H1):** Students who attend the lectures/ tutorials/ workshops regularly are able to pass the exam.

Hypothesis 2 (H2): Students who attend the lectures/ tutorials/ workshops regularly are still not able to pass the exam.

Table.1. Results of the survey (empirical)

	A	B	C	D
Achievement		Regularly attended the lectures/ tutorials/ workshops	Occasionally or rarely attended the lectures/ tutorials/ workshops	Total
Passed the exam		58	1	59
Did not pass the exam		24	5	29
Total		82	6	88

Table.2. Expected results (theoretical)

	A	B	C	D
Achievement		Regularly attended the lectures/ tutorials/ workshops	Occasionally or rarely attended the lectures/ tutorials/ workshops	Total
Passed the exam		54.98	4.02	59
Did not pass the exam		27.02	1.98	29
Total		82	6	88

Statistical method of Chi-square test

Group I : **Hypothesis 1 (H1):** Students who attend the lectures/ tutorials/ workshops regularly are able to pass the exam.
Hypothesis 2 (H2): Students who attend the lectures/ tutorials/ workshops regularly are still not able to pass the exam.

Table.3. Calculating the values of Chi-square to check H1 and H2

A	B	C	D	E	F
	An empirical result (O)	A theoretical result (E)	Deviation (O _i -E _i)	Square deviation (O _i -E _i) ²	Chi square (O _i -E _i) ² /E _i
Regularly attended the lectures/ tutorials/ workshops and passed the test	58	54.98	3.02	9.12	0.17
Regularly attended the lectures/ tutorials/ workshops and did not pass the test	24	27.02	-3.02	9.12	0.34

$$\chi^2 = 0.51$$

Table.3. Calculating the values of Chi-square to check H1 and H2

A	B	C	D	E	F
	An empirical result (O)	A theoretical result (E)	Deviation (O_i-E_i)	Square deviation (O_i-E_i)²	Chi square (O_i-E_i)²/E_i
Regularly attended the lectures/ tutorials/ workshops and passed the test	58	54.98	3.02	9.12	0.17
Regularly attended the lectures/ tutorials/ workshops and did not pass the test	24	27.02	-3.02	9.12	0.34

Degrees of freedom :
 $DF=(row-1)*(col-1) = (2-1)*(2-1)=1$

Probability for choosing the wrong hypothesis
 $p=0.05$

Chi-Square Distribution Table

Degrees of freedom	Probability (p) value									
	0.99	0.95	0.80	0.70	0.50	0.30	0.20	0.10	0.05	0.01
1	0.001	0.004	0.06	0.15	0.46	1.07	1.64	2.71	3.84	6.64
2	0.20	0.10	0.45	0.71	1.30	2.41	3.22	4.60	5.99	9.21
3	0.12	0.35	1.00	1.42	2.37	3.67	4.64	6.25	7.82	11.34

$\chi^2=0.51$




Critical value :
 $\chi^2 (0.05) = 3.84$


Hypothesis 1 ? OR Hypothesis 2?

$$\chi^2=0.51$$

$$\chi^2 (0.05) =3.84$$

$$\chi^2 < \chi^2 (0.05)$$


Conclusion: There is no significant statistical difference between the theoretical and empirical values, i. e. the results from the field correspond to the expected theoretical results of the survey.



Hypothesis 1 (H1):

Students are able to pass the exam if they attend the lectures/ tutorials/ workshops regularly.

Group II : **Hypothesis 3 (H3):** Students who attend the lectures/ tutorials/ workshops occasionally are able to pass the exam. (This thesis is valid if the Chi square is smaller than the critical value.)

Hypothesis 4 (H4): Students who attend the lectures/ tutorials/ workshops occasionally are not able to pass the exam. (This thesis is valid if the Chi square is bigger than the critical value)

Table.4. Calculating the values of Chi-square to check H3 and H4

A	B	C	D	E	F
	An empirical result (O)	A theoretical result (E)	Deviation (O _i -E _i)	Square deviation (O _i -E _i) ²	Chi square (O _i -E _i) ² /E _i
Occasionally or rarely attended the lectures/ tutorials/ workshops and failed the exam	5	1.98	3.02	9.12	4.61
Occasionally or rarely attended the lectures/ tutorials/ workshops and passed the exam	1	4.02	-3.02	9.12	2.27

$\chi^2=6.88$

Table.4. Calculating the values of Chi-square to check H3 and H4

A	B	C	D	E	F
	An empirical result (O)	A theoretical result (E)	Deviation (O_i-E_i)	Square deviation (O_i-E_i)²	Chi square (O_i-E_i)²/E_i
Occasionally or rarely attended the lectures/ tutorials/ workshops and failed the exam	5	1.98	3.02	9.12	4.61
Occasionally or rarely attended the lectures/ tutorials/ workshops and passed the exam	1	4.02	-3.02	9.12	2.27

Degrees of freedom :
 $DF = (row-1) * (col-1) = (2-1) * (2-1) = 1$

$p = 0.05$

Chi-Square Distribution Table

Degrees of freedom	Probability (p) value									
	0.99	0.95	0.80	0.70	0.50	0.30	0.20	0.10	0.05	0.01
1	0.001	0.004	0.06	0.15	0.46	1.07	1.64	2.71	3.84	6.64
2	0.20	0.10	0.45	0.71	1.30	2.41	3.22	4.60	5.99	9.21
3	0.12	0.35	1.00	1.42	2.37	3.67	4.64	6.25	7.82	11.34
4	0.30	0.71	1.65	2.20	3.36	4.88	5.99	7.78	9.49	13.28


Chi square value
 $\lambda^2 = 6.88$

Critical value for probability of 5% : $\lambda^2(0.05) = 3.84$


Hypothesis 3 ? OR Hypothesis 4?

$$\chi^2=6.88$$

$$\chi^2 (0.05) =3.84$$

$$\chi^2 > \chi^2 (0.05)$$


Conclusion: There is a significant statistical difference between the theoretical and empirical values, i. e. the results from the field do not correspond to the expected theoretical results of the survey.



Hypothesis 4 (H4):
**Students who occasionally attend the lectures/
tutorials/ workshops are not able to pass the exam.**

Hypothesis 1 (H1),

which states that students are able to pass the exam if they attend the lectures/ tutorials/ workshops regularly, is proven.

Hypothesis 4 (H4),

which states that students who occasionally attend the lectures/ tutorials/ workshops are not able to pass the exam, is proven.

- **Programming is a very useful skill.**
- **It can contribute to a successful career.**



- **Programming is a challenging and difficult activity.**
- **The success is possible for students who regularly attend the lectures, exercises and workshops.**
- **An additional effort at home in practicing and learning from the solved examples is required.**

CONCLUSION

Programming is a skill.

Our novice programmer will have to write many lines of code.



Thank you
for your
attention!

E-LEADER CONFERENCES
Vienna, June 6-8, 2016