Students' attitude to the use of Micro : bit devices in teaching

Pavlina, Krešimir; Ivanjko, Tomislav; Mihaljević, Antonija

Source / Izvornik: **14th International Technology, Education and Development Conference (INTED2020) : proceedings, 2020, 4911 - 4917**

Conference paper / Rad u zborniku

Publication status / Verzija rada: **Published version / Objavljena verzija rada (izdavačev PDF)**

https://doi.org/10.21125/inted.2020.1343

Permanent link / Trajna poveznica: https://urn.nsk.hr/urn:nbn:hr:131:201231

STUDENTS' ATTITUDE TO THE USE OF MICRO:BIT DEVICES IN TEACHING

Krešimir Pavlina, Tomislav Ivanjko, Antonija Mihaljević

University of Zagreb (CROATIA)

Abstract

The BBC micro:bit is a handheld, programmable micro-computer, widely used in primary schools in Croatia. The aim of this paper is to explore students' attitudes to the use of micro:bit devices in teaching in primary school. Conducted research examine how students experience micro:bit in teaching. The research was conducted by the survey method in two primary schools in four eighth grades. Questionnaire was composed of 10 statements with which students were asked to express their attitudes on Likert's scale.

For the purposes of research, three hypotheses were set. The first hypothesis was: There is a difference between female and male students in accepting micro:bit. The results show that 96% of male students think it is interesting to use micro:bit in classroom, while 62.5% of female students think it is interesting. When asked whether they think about new ways to use micro:bit 40% of male students and just 6.25% of female students agreed or completely agreed. That micro:bit is fun to use, consider 92% of male students and 75% of female students, and 63.51% of male students and 50% of female students think it is useful. When asked whether they want to use micro:bit more often, 76% of male students and 56.25% of female students agreed. These results show that male students generally have more positive attitudes towards the use of micro:bit in teaching.

The second hypothesis was: Students experience that micro:bit is easy to use. With the statement that micro:bit is easy to use, 70.73% of respondents agree and that micro:bit is complicated to use considered only 7.32% of the students. The same number of respondents reported being confused when working with micro:bit, while 80.49% of respondents estimated that they understood how to use micro:bit. These results show that students experience micro:bit as simple and intuitive.

The third hypothesis was: Students with predominantly excellent grades positively accept the use of micro:bit in teaching. Almost 50% of respondents reported top grade rating (5). Among them, 75% want to use more micro:bit in classroom, 95% think the use of micro:bit is fun, equal number find it interesting to use and 80% of them estimate that the use of micro:bit is useful to them personally. These high rates point to a positive reception of micro:bit by students with excellent grades.

Results of this research show the dominant positive attitudes of the students to the use of micro:bit in teaching, and it is certainly recommended to continue with similar research to gain the best insight into the technology itself and the student experience with the aim of maximizing the positive effects of micro:bit on teaching process. Meanwhile, the micro:bit have started to be used around the world (Denmark, Australia, Finland, China Hong Kong, Japan, etc.), which confirms that this is a highly potent technology with far-reaching consequences, which should continue to be followed by science and profession and adapt to support teaching for realization of maximum student development.

Keywords: micro:bit, technology, teaching, physical computing.

1 INTRODUCTION

Although the number of years the BBC micro:bit computers are present in classrooms can be counted on the fingers of one hand, it is possible to find research in scientific and professional context that has examined its pedagogical relevance.

Gibson and Bradley [1] conducted a survey in primary schools in Northern Ireland with the aim of examining students' experiences when using micro:bit computers. They found that 64% of students thought micro:bit was simple or very easy to use, which is in line with the official micro:bit website, which states that the micro:bit provides a "super simple and no scary user experience" (BBC micro: bit, 2015, according to Gibson and Bradley [1]). A high percentage of students, as high as 91%, found themselves enjoying the use of micro:bit computers, while 90% stated that using micro:bit computer was useful or extremely helpful in solving problems. This finding is consistent with Rocks paper (2016,

according to Gibson and Bradley [1]) according to which micro:bit is not only a tool for developing programming skills, but also for developing problem solving skills.

Videnovik et al. [2] examined students' experiences shortly after using the micro:bit computer and found it very suitable for group work, so students developed their communication skills and some team leadership skills. They also found increased students' interest in continuing to develop their computer thinking skills, but also increased male students interest in working with the micro:bit compared to female students. Female students, on the other hand, were reserved and should have been encouraged to engage in coding, but once they did, they provided more accurate and precise answers than male students. The authors think that the preference for learning programming does not lie in gender specificities, but rather in the learning opportunities that teachers and society create for students.

Sentance et al. [3] conducted interviews with students and teachers with the aim of obtaining feedback on the use of micro:bit computers in teaching. Each interviewed teacher mentioned that students enjoyed the use of micro:bit computers and cited the ease of programming and the creation of a concrete and functional product as reasons. They also stated that students were happy to embrace new technology, even students with disabilities who are otherwise harder to motivate to program. On the other hand, after a while, the gifted students were no longer interested in micro:bit computers, i.e. two students stated that they did not want to bring micro:bit home because they had "exhausted all its potentials at school" (p. 92). There is nothing strange about this, because gifted children who attend regular school curriculum very quick to adopt the curriculum and they may be bored [4], so it is important to recognize gifted children, identify what kind of giftedness they have and individualize their curriculum so they could fulfill their potential and develop according to their abilities.

Research on the use of micro:bit computers in teaching is also available in the Croatian scientific context, so that Ređep, Leček and Vrbanec [5] conducted a survey on a sample of 164 sixth, seventh and eighth grade students. They put forward three hypotheses. They rejected the first hypothesis, which was that “Boys and girls equally like programming”, because it was found that 88.4% of the total number of boys surveyed like to program, while only 48.7% like programming. The second hypothesis was "Students want to program more with micro:bit in computer science school subject" and it was confirmed because 76.2% of students said yes to "I want to program more in computer science school subject with the use of micro:bit". A third hypothesis was also confirmed: "Using micro:bit is more interesting and easier to program for students."

2 METHODOLOGY

Micro:bit computers has been introduced into Croatian classrooms a few years back, so it is not surprising that the domestic scientific context lacks papers exploring its role in teaching. Some papers do exist, however, but belong to the natural sciences and explore the possibilities of applying micro:bit in teaching [6][7]. Such papers are extremely important because, among other things, they can provide inspiration to teachers on how to incorporate micro:bit into the classroom. In contrast to these papers, this paper is less focused on the technical capabilities of the device itself and more on its reception by the students themselves. More specifically, the aim of this research is to examine how students experience working with the micro:bit in teaching.

Three hypotheses were created for the purpose of the research. Previously mentioned research Videnovik [2] and Ređep, Leček and Vrbanec [5] presented the existence of gender differences when using micro:bit. And many other studies that do not focus on micro:bit but research some other technologies prove the existence of gender differences in the perception or use of the technology being researched (for example, [8], [9]). Therefore, based on these studies, the first hypothesis was formulated:

H1: There is a difference between female and male in acceptance of micro:bit.

Almost all of the research presented [1] [3] [5] came to the realization that micro:bit is easy to use for students, which is also in line with the official micro:bit page at to which simplicity is introduced as one of the features of micro:bit. Based on this, a second hypothesis was raised:

H2: Students experience micro:bit easy to use.

The better the students' academic achievement, the more they have the skills they need to learn and to work harder at school [10]. In addition, students who evaluate their social skills positively and deem

them desirable and appropriately developed are achieving better academic performance [11]. Therefore, a third hypothesis was raised:

H3: Students with dominantly excellent grades positively accept the use of micro:bit in teaching.

This research belongs to a quantitative methodology and was conducted using a survey method. The survey method is a special form of non-experimental research that uses as a basic data source personal statement of opinions, beliefs, attitudes and behavior, obtained through an appropriate standardized set of questions. Given that the intention of the research was to examine students' attitudes, the Likert scale was used in the questionnaire, which allowed students to express level of agreement or disagreement with ten statements about micro:bit.

The sample was non-probabilistic consisting of 41 eighth-grade students (total of 4 classes) from two primary schools. Out of 41 students, 25 are males and 16 are females. In the questionnaire, one of the questions was “Have you worked with a micro:bit computer in your education so far?”, With answers “Yes” or “No” required. This question was asked to eliminate from the sample the answers of those students who answered "No" (due to, for example, absenteeism during those teaching units), however, all respondents completed "Yes" so that the sample remained in its original form.

3 RESULTS

Given the sample size and the survey questionnaire, data was analyzed manually. The following tables summarizes the results on Likert assessment scale, expressed as a percentage.

Students were asked to express their opinion about their interest in using micro:bit, applicability and creativity while using micro:bit in teaching and their opinions about use of micro:bit computers in teaching. Last four statements allowed students to express their opinions about ease and understanding of using micro:bit.

Two sentences allowed students to express their views on how interested they are to use micro:bit computer and how fun it is to use it.

Table 1. Student responses to the statement "It is interesting for me to use micro:bit in teaching."

	Percentage (%) - Total	***Percentage (%) - Male***	***Percentage (%) – Female***
Strongly disagree	9,76	0	25
Disagree	0	0	0
Neutral	7,32	4	12,5
Agree	58,54	64	50
Strongly agree	24,39	32	12,5

If we would attribute values to Likert scale where Strongly disagree would be attributed 1 and Strongly agree would be attributed 5. Average student attitude to first statement would be 3,87 and it is interesting to note that average for male students is 4,28 while average for female students is 3,25. So it could be concluded that on average male students agree that it is interesting to use micro:bit in teaching while female students are on average neutral. Difference between male and female students’ answers to this statement were marginally statistically unsignificant (χ^2=9,061; df=4; p=0,05959).

Table 2. Student responses to the statement "I think it's fun to use micro:bit in teaching."

	Percentage (%) - Total	***Percentage (%) - Male***	***Percentage (%) – Female***
Strongly disagree	9,76	4	18,75
Disagree	0	0	0
Neutral	4,88	4	6,25
Agree	34,15	36	31,25
Strongly agree	51,22	56	43,75

To the statement that it's fun to use micro:bit in teaching students expressed average attitude of 4,17, male students 4,4 and female students 3,81. Difference in male and female students' answers were not statistically significant (χ^2=2,62717; df=4; p=0,62202)

Students' attitudes toward applicability and creativity when using micro:bit computers were tested by the following two statements.

Table 3. Student responses to the statement "I often look for new ways that I could use the micro:bit."

	Percentage (%) - Total	***Percentage (%) - Male***	***Percentage (%) – Female***
Strongly disagree	17,07	20	12,5
Disagree	14,63	4	31,25
Neutral	41,46	36	50
Agree	21,95	32	6,25
Strongly agree	4,88	8	0

Average student answer to this question was 2,83, male students averaged on 3,04 and female students on 2,50. Difference in answers between male and female students was found to be statistically significant (χ^2=9,95997; df=4; p=0,04111).

Table 4. Student responses to the statement "I think it is useful for me when we use micro:bit in class."

	Percentage (%)	***Percentage (%) - Male***	***Percentage (%) – Female***
Strongly disagree	7,32	8	6,25
Disagree	4,88	0	12,5
Neutral	21,95	16	31,25
Agree	46,34	44	50
Strongly agree	19,51	32	0

On this question average male student answer was 3,92 and female student 3,25. Difference in male and female students on this question was not statistically significant by only a small margin (χ^2=9,39523; df=4; p=0,05195).

The following two tables presents results of statements which explored students' attitudes toward the use of micro:bit computers in teaching.

Table 5. Student responses to the statement "I want micro:bit to be used more often in teaching."

	Percentage (%)	***Percentage (%) - Male***	***Percentage (%) – Female***
Strongly disagree	9,76	4	18,75
Disagree	2,44	0	6,25
Neutral	19,51	20	18,75
Agree	41,46	40	43,75
Strongly agree	26,83	36	12,5

Average answer to this question was 3,7316 and difference between male (4,04) and female (3,25) average answer was 0,79 which was not statistically significant (χ^2=5,78721; df=4; p=0,21561).

Table 6. Student responses to the statement "I don't like it when we use the micro:bit in class."

	Percentage (%)	Percentage (%) - Male	Percentage (%) – Female
Strongly disagree	31,71	44	12,5
Disagree	51,22	44	62,5
Neutral	9,76	12	6,25
Agree	2,44	0	6,25
Strongly agree	4,88	0	12,5

It can be noticed that female student answer was more neutral with average value of 2,43 than male student (1,68). It should be noted that differences in answers to this question from male and female students were not statistically significant (χ^2=8,72311; df=4; p=0,06841).

Students' attitudes toward ease and understanding of using micro:bit computer were expressed in following statements.

Table 7. Student responses to the statement "Micro:bit is easy to use."

	Percentage (%)	Percentage (%) - Male	Percentage (%) – Female
Strongly disagree	0	0	0
Disagree	4,89	4	6,25
Neutral	24,39	16	37,5
Agree	53,66	60	43,75
Strongly agree	17,07	20	12,5

Student average answer to this question was 3,82 and there was small difference in average answer between male (3,96) and female (3,625) students. Difference in answer distribution between male and female students were not statistically significant (χ^2=2,75179; df=4; p=0,60018).

Table 8. Student responses to the statement "I think working with micro:bit is complicated."

	Percentage (%)	Percentage (%) - Male	Percentage (%) – Female
Strongly disagree	24,39	28	18,75
Disagree	46,34	48	43,75
Neutral	21,95	20	25
Agree	4,88	0	12,5
Strongly agree	2,44	4	0

Students on average disagree (2,1464) that working with micro:bit is complicated with small difference between male (2,04) and female (2,3125) students. Differences in answers between male and female students were not statistically significant (χ^2=4,25639; df=4; p=0,37242).

Table 9. Student responses to the statement " I understand how to work with micro:bit "

	Percentage (%)	Percentage (%) - Male	Percentage (%) – Female
Strongly disagree	0	0	0
Disagree	4,88	4	6,25
Neutral	14,63	8	25
Agree	58,54	64	50
Strongly agree	21,95	24	18,75

Average answer to this statement was 3,97 and it should be noted that in this question there was smallest difference in male (4,08) and female (3,81) students' opinions and as can be expected this difference was not statistically significant (χ^2=2,47708; df=4; p=0,64874).

Table 10. Student responses to the statement "I experience confusion when working with micro:bit."

	Percentage (%)	*Percentage (%) - Male*	*Percentage (%) – Female*
Strongly disagree	24,39	28	18,75
Disagree	36,59	44	25
Neutral	31,71	28	37,5
Agree	7,32	0	18,75
Strongly agree	0	0	0

On average students disagree with this statement (2,2198). With relatively small difference in average opinion between male (2,00) and female (2,5625) students. Differences in opinions by gender was not statistically significant (χ^2=6,27011; df=4; p=0,17986).

4 DISCUSSION

The first hypothesis was: "There is a difference between female and male acceptance of micro:bit". Although statistically significant difference between male and female students' opinion about micro:bit was found only on statement "I often look for new ways that I could use the micro:bit." it can be concluded that there is no reason to reject this hypothesis because differences in answers to three questions ("It is interesting for me to use micro:bit in teaching.", "I think it is useful for me when we use micro:bit in class.", "I don't like it when we use the micro:bit in class.") were not statistically significant by only a small margin. These results show that male students generally have a more positive attitude towards the use of micro:bit in teaching, so we can conclude that there is no reason to reject the hypothesis based on gathered results.

Second hypothesis was: "Students experience micro:bit easy to use". In this research 70.73% of respondents agree with the statement that micro:bit is easy to use. Only 7.32% of the students surveyed consider the micro:bit complicated to use. The same number of respondents reported feeling confused when working with micro:bit, while 80.49% of respondents said they understood how to work with micro:bit. These results show that students in high percentage experience working with micro:bit simple and intuitive, so we can conclude that there is no reason to reject the hypothesis based on the results.

The third hypothesis was: Students with predominantly excellent grades positively accept the use of micro:bit in teaching. From 41 students, 20 indicated in the survey that their most common grade was excellent (5). Among them, 75% want to use micro:bit more often, 95% think using micro:bit is fun, and as many find it interesting when using micro:bit in class and 80% of them estimate that using micro:bit is useful for them personally. These high percentages indicate a positive reception of micro:bit by students with excellent grades, and therefore we can conclude based on the results that there is no reason to reject the hypothesis.

5 CONCLUSIONS

The obtained results show the dominant positive attitudes of students towards the use of micro:bit in teaching, so it is certainly recommended to continue with similar research in order to gain a better insight into the technology and student experiences in order to maximize the positive effects of micro:bit on teaching process. Meanwhile, micro:bit computers has begun to be used around the world (Denmark, Australia, Finland, China Hong Kong, Japan, etc.), which confirms that this is a highly potent technology with far-reaching consequences, which certainly both science and the profession should continue to monitor and tailor teaching to support overall student development.

REFERENCES

[1] S. Gibson, P. Bradley, A study of Northern Ireland Key Stage 2 pupils' perceptions of using the BBC Micro:bit in STEM education. Belfast: St. Mary's University College, 2017

[2] M. Videnovik et al, The BBC Micro:bit in the International Classroom: Learning Experiences and First Impressions. 17th International Conference on Information Technology Based Higher Education and Training (ITHET), 2018

[3] S. Sentance et al, "Creating cool stuff" – Pupils' experience of the BBC micro:bit. Proceedings of the 48th ACM Technical Symposium on Computer Science Education: SIGCSE, 2017

[4] D. Adžić, Darovitost i rad s darovitim učenicima: kako teoriju prenijeti u praksu. Život i škola, 25, 171-184, 2011

[5] T. Ređep, T. Leček, D. Vrbanec, Utjecaj korištenja micro:bit tehnologije na učenje programiranja u sklopu nastave informatike u osnovnoj školi. 41. međunarodna konferencija MIPRO, 2018

[6] P. Kalafatić, Upotreba micro:bit uređaja u dizajnu demonstracijskih pokusa u osnovnoj školi. Retrieved from URL: https://urn.nsk.hr/urn:nbn:hr:217:320305, 2018

[7] N. Sekulić, Upotreba micro:bit uređaja u dizajnu demonstracijskih pokusa. Retrieved from URL: https://urn.nsk.hr/urn:nbn:hr:217:412361, 2018

[8] D. Gefen, D. W. Straub, Gender Differences in the Perception and Use of E-mail. MIS Quarterly, 21(4), 389 – 400, 1997

[9] A. H. K. Yuen, W. W. K. Ma, Gender Differences in Teacher Computer Acceptance, Journal of Technology and Teacher Education, 10(3), 365 – 382, 2002

[10] M. Rijavec, Z. Raboteg-Šarić, R. Franc, Komponente samoreguliranog učenja i školski uspjeh. Društvena istraživanja, 8(4), 529 – 541, 1999

[11] V. Buljubašić Kuzmanović, Odnos školskog uspjeha i socijalnih vještina kod učenika osnovne škole. Život i škola, 38 – 53, 2012