The Digital Poetry Machine Supporting Lower Secondary Students' Poetry Writing

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Abstract

In this study we investigate whether a digital tool supports lower secondary school students in

poetry writing and influences on students' perceptions of poetry. It is essential to find new

means to develop students' weakening writing competencies with digital tools and methods.

This study analyzed students' perceptions of poems before and after writing poems with a co-

creative tool called the Poetry Machine and the log data of poems written with it. We found that

draft poems offered by the tool supported the students. Interestingly, this support received a

higher evaluation by male students compared with the assessment by female students. The

participants' perceptions of poetry writing changed positively during the period when using the

tool and most of them considered writing with it to be easy and fun. Our findings suggest that

digital tools have the potential to change positively perceptions about challenging literary forms,

such as poetry, and especially to support male students in writing. Digital tools, such as the

Poetry Machine, offer opportunities to motivate students in online learning. However, the young

students need support both in face-to-face and online learning environments.

Keywords: digital literacy, digital tool, Poetry Machine, poetry writing, lower secondary

education

The increasing use of digital technology in school and online learning and teaching have heightened the interest in studying students' writing practices with digital tools. In this study, the focus is on students' poetry writing with digital tools. Students can experience poetry writing through the characteristics and affordances of digital tools easier than through traditional means. It is important that students write their own poems in addition to just reading them, which is now a common situation at school (Certo et al., 2012; Xerri, 2013). By writing poems, the students learn to understand poetry and its structures and features better. Poetry writing gives students an opportunity to express themselves and makes them into producers of poems. Especially in technological environments, in which students write with the support of digital tools, their role as content producers is emphasized and they are no longer only consumers (Niemi & Multisilta, 2016).

Despite poetry's significant role as one of the main genres in literature and the emphasis on poetry as a genre in the curriculum of secondary education in many countries (Fleming, 1992; Sigvardsson, 2017, 2019), poetry is feared and unpopular in schools (Fleming, 1992; Hawkins & Certo, 2014), and students consider poetry writing to be difficult (Wilson, 2007). It is also commonly known that poetry writing improves creative thinking and linguistic skills, which are necessary in all kinds of writing (Edward-Groves, 2012; Myhill & Wilson, 2013).

Learning to write poems is different from other types of writing in school because poetic language has structural features including the line and stanza structure as well as rhythm or meter (Wilson, 2007). Poetry writing is a challenging creative process that demands cognitive and intellectual work while also being linguistic and imaginative play (Wolf, 2006; Certo, 2015). To support the learning of poetic structures and features, Certo (2015) and Wilson (2007) emphasized practices in which students are offered published poems as models and mentor texts. New and innovative digital writing tools together with mentor and model texts mediate students to enhance their writing competencies (Ching, 2018; Dredger & Martin, 2017; Howell,

2018; Kang, 2018; Nobles & Paganucci, 2015), not only in poetry writing but in all writing genres.

Students' attitudes influence writing: do they favor approaching or avoiding the task and what is their motivational state (Hamilton et al., 2013). Motivation contributes to the quality of written texts (Troia et al., 2013). Emotional aspects, such as considering writing tasks as fun, combined with commitment to work, supports the writing process (Niemi & Multisilta, 2016). Finding enjoyment in reading and writing and spending time on them affects both intrinsic motivation and creative thinking, which further also affect self-estimated ability to manage writing tasks (Hamilton et al., 2013; Wang, 2012).

Interest and abilities in writing differ between female and male students. Male students' writing attitudes are more negative, and they dislike writing in school, and because of their poorer literacy competency they are less successful than female students (Merisuo-Storm, 2006). Female students' writing abilities are also better than male students' (Troia et al., 2013). According to the PISA 2018 results, the gender gap in literacy in favor of female students has also been one of the highest in Finland (Programme for International Student Assessment [PISA], 2019). Regarding writing poetry, both female and male students concern it the least attractive genre of writing, though female students enjoy it more than male participants (Merisuo-Storm, 2006). To support poetry writing it has been suggested that the use of computers and model texts can motivate and support male students to write (Hawkins & Certo, 2014; Merisuo-Storm, 2006). On the contrary, Hanratty (2011) argues that they are at least as capable of responding to the demands of poetry as female students.

Broadening Definition of Literacy

Digitalization is changing the nature and importance of literacy. It has changed the writing process, which now requires at least technical skills and creativity (Edwards-Groves, 2012; EU, 2012a). The concept of literacy is changing to digital literacy, and it can refer to

information and communication technology (ICT) skills (Hall et al., 2014) or emphasize media

literacy (Buckingham, 2015; Erstad, 2015). It can also mean the capacity to understand and

create multimodal texts (Baird & Henninger, 2011; Merchant, 2007). Moreover, it can cover a

combination of technical, cognitive and emotional-social skills and practices (Aviram & Eshet-

Alkalai,2006; Lankshear & Knobel, 2015). The definition of digital literacies changes as

technology develops, with new technologies often requiring new skills (Coldwell-Neilson, 2017).

In this study, we define digital literacy similarly to Hague and Williamson (2009), as a

combination of reading and writing of digital texts, social awareness, critical thinking, and

competencies in using digital tools. In school, this means the students' ability to use digital tools

to enhance their skills, knowledge, and understanding as learners and citizens.

Students perceive their writing to be superior with the support of digital tools (Nobles &

Paganucci, 2015). Even though digital tools motivate students to write (Ching, 2018; EU, 2012b;

Howell, 2018; Kang, 2018; Nobles & Paganucci, 2015), there is a gap between print-based

literacy practices in school and digital reading and writing at home (Erstad, 2015; EU, 2012a;

Merchant, 2007). To narrow the gap, students' home experiences on entertainment devices

need to be linked with their academic lives. Although writing has been identified as a key

competence and despite many students having difficulties with it, writing has received much

less attention than reading at the international policy level (Blikstad-Balas et al., 2018; EU,

2012b; OECD, 2009). The change from traditional literacy to digital literacy causes pressure on

schools (Blikstad-Balas et al., 2018; Edwards-Groves, 2012; EU, 2012b) and it is essential to

find new means to develop students' competencies in writing with digital tools and new

methods.

Writing poems at secondary school, and with the support of digital tools, is an

understudied topic. The research considering students' poetry writing has tended to focus on

the poetic language features of elementary school students' poems and children's intertextual

poetry writing practices (Certo, 2015; Kamberelis, 1999; Wilson, 2007; Wolf, 2006). A recent

study by Dreger and Martin (2017) investigated how graduate preservice teachers mentored 9th

-grade students' poetry writing in an online course. Most studies have emphasized reading,

interpreting and performing poems (Fleming, 1992; Kelly, 2005; Smith, 2010), or teachers'

perceptions of teaching poetry (Myhill & Wilson, 2013; Xerri, 2013), as opposed to students'

perceptions of poetry and practices of poetry writing, especially with digital tools. This study

seeks to fill these gaps in investigating the use by lower secondary students of a digital tool to

support poetry writing in school and perceptions of it.

The Aim and the Research Questions

The aim in this study was to investigate whether lower secondary students' experience

of a digital co-creative tool called the Poetry Machine supported them in the challenging task of

writing poems. We also considered whether there are differences regarding the self-estimated

support of the digital tool between different student groups according to perceptions of literacy,

grades, and gender. Previous research has established that poetic language can be taught by

offering models of poems and that writing with computers can especially motivate male students

(Hawkins & Certo, 2014; Merisuo-Storm, 2006). In our study, the digital tool, based on applying

artificial intelligence in the language structures, offers those models by generating a draft poem

for a student and then offering various specific tools to develop it by using a computer, so that a

poem is eventually created through human-computer co-creation (Kantosalo et al., 2014). We

consider first the research question (1) How do students use the digital Poetry Machine? The

second question is a two-fold question (2) How does writing with the support of the Poetry

Machine influence students' perceptions of poetry writing, and how do these perceptions differ

according to students' perceptions of literacy, grades, and gender?

Methods

Context and Participants

The study was conducted in a lower secondary school in Finland. The Finnish National

Core Curriculum emphasizes 'multiliteracy', the ability to produce and interpret diverse texts

since 2014 (FNAE, 2014). This has increased the need to use digital tools for writing.

Sixty-one students in two 7th grade basic education groups (mean age 13.2 years)

participated in the study (29 males, 32 females) in Finland. All but two of them (99.8%, n = 59)

spoke Finnish as their first language and 1.2% (n = 2) of participants spoke a second language

at home (Estonian and English). The students are from the same local area of middle-class

families because in Finland, students usually go to the neighborhood school. The students had

used digital technologies during earlier studies of the Finnish language and literature and their

teachers assessed their competence in digital technology as good. The students' grades in the

Finnish language and literature subject according to the school report were the following:

excellent 3% (2), very good 51% (31), good 28% (17), satisfactory 16% (10), and moderate 2%

(1).[1] Female participants' average grade in the subject was statistically significantly higher

compared with the male participants' average grade (female mean 8.7, male mean 7.9, p=.003)

The two participating teachers worked in the same school. They were female, aged 28 and 51

years old, respectively; their teaching experience was (1) three years and (2) 26 years. They

showed interest in integrating digital technology in their teaching, and they were committed to

the teaching and research process using the Poetry Machine. The teachers were recommended

for the study by a local active ICT teacher.

Participation in the research was voluntary. Permissions for students to participate in the

study were obtained from their parents, after informing them about the purpose of the study and

data collection procedures. Data were collected anonymously.

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[1]   Grades: 6 = moderate, 7 = satisfactory, 8 = good, 9 = very good, 10 = excellent

Apparatus

The Poetry Machine is a co-creative tool designed for writing poetry (Kantosalo et al.,

2014), and it was created in a project investigating computational linguistic creativity. The Poetry

Machine uses corpus-based methods to find associated words around an offered topic and then

produces poetry about it (Toivanen et al., 2012). Thus, the Poetry Machine produces a

nonsense draft poem, which has five lines. The nonsense structure and poetic features in draft

poems provide affordances to the user, who can modify this draft via a colorful drag-and-drop

interface by adding, moving, editing and deleting individual words and whole lines, and writing a

new title to the poem; the Poetry Machine supports the writer by adding lines on request and

suggesting new words, optionally with rhymes (assonance, consonance, full-rhymes, swap,

alliteration) and meter. For research purposes, all user actions are recorded in log files, allowing

investigation of students' poetry writing processes. The Poetry Machine user interface in Figure

1 depicts the main functions of the Poetry Machine and a poem produced by it.

Figure 1: *Sample screenshot illustrating a poem produced with the Poetry Machine*
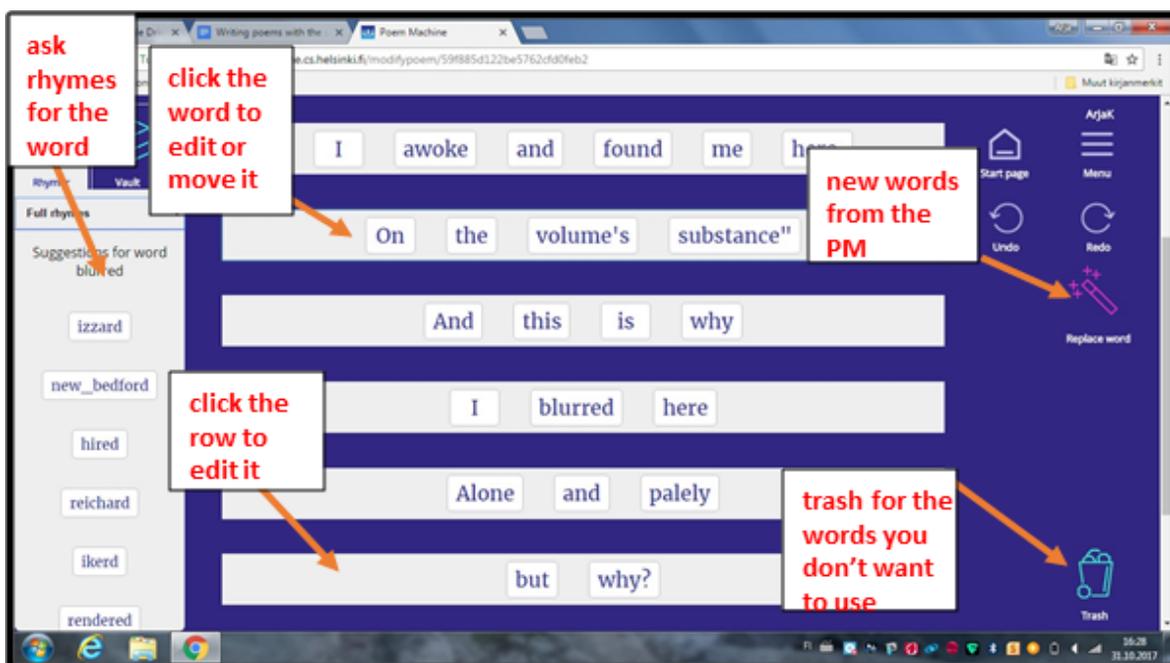
Highlights of the main editing functions were added.

Pedagogical Design of the Lessons

The participating teachers planned three lessons (each of 45 minutes) in which the

Poetry Machine was used. They explained to the students how to work with the Poetry Machine:

how to select a topic for the poem from a list of themes and then modify the suggested draft

poem via dragging and dropping words and lines, and how to ask for assistance about several

poetic features or more material from the Poetry Machine. The teachers introduced the task of

composing at least one poem during the first lesson. Each student worked alone and used the

Poetry Machine with a laptop computer. In the second lesson, the students were first asked to

compose a poem of their own, and then they worked in pairs examining each other's poems and

discussing them. In the third lesson, the students worked in groups, and they were asked to

present their Poetry Machine-supported poems to each other and discuss the features of the

program they had used in writing the poems. Poetry was not taught as a discrete genre before

the research. Therefore, the features and structures of poetry may have been unfamiliar to the

students.

Data Collection

The study was based on two quantitative data sets: (1) The log data consisted of all the

changes that students made to the poems, informing the researchers about the writing process;

(2) Pre- and post-questionnaires indicated students' perceptions of literacy, and especially their

perceptions of writing poems. The data for the study were collected in March - April 2017.

Log data. The log data contains the number of poems students wrote, as well as the

number and type of changes they made to the draft poems produced by the Poetry Machine. In

total, students wrote 228 poems.

Pre- and post-questionnaires about perceptions of writing poems. A pre-

questionnaire was created to investigate students' perceptions of literacy before they used the

Poetry Machine. A pilot study was conducted with students in February 2017 to test the

questionnaires, and it led to a few minor changes in the final questionnaire. The test was also

used to create guidelines for participating teachers on how to use the Poetry Machine in their

teaching and to ensure what the teacher's role during the investigation was to be. With the final

questionnaire, we collected data related to enjoyment of literacy and self-estimated writing

abilities. It consisted of five background questions and 24 statements: seven statements about

perceptions of literacy, 16 about perceptions of poems and one about using a computer to

support writing (see Appendix A). The statements about perceptions of literacy were based on

the studies of Hamilton et al. (2013), and the statements about enjoyment of reading, writing,

and poems on the studies of Wang (2012). The rest of the statements about students' writing

abilities and difficulties were based on the first author's experiences as a teacher. Statements

such as "A computer supports me in writing" and "A model of a poem would support me in

writing a poem" were based on the hypothesis that the Poetry Machine supports students,

because of the use of computer and draft poems the tool offers.

Students' perceptions of reading and writing poetry and other genres were surveyed with

a 5-point Likert scale: (1 = *not at all;* 5 = *a great deal*). The items included positive statements

such as "I enjoy poems" (Appendix A). Students' opinions of poems and writing were surveyed

with a 4-point Likert scale which was selected to avoid students selecting a neutral alternative (1

= *completely disagree;* 4 = *completely agree*). The statements were such as "I think that I can

write poems" (Appendix A). There was also an open-ended question of students' descriptions of

poems.

The post-questionnaire was created to investigate students' perceptions of writing

poems after they had written poems with the support of the Poetry Machine. It was administered

to evaluate the students' writing experience regarding the usage of the Poetry Machine. It

consisted of five background questions and 14 statements which were based on hypothetical

assumptions about the support provided by the Poetry Machine (see Appendix B). They

included statements such as "The opportunity to edit a poem (with the Poetry Machine)

supported me in writing". They were surveyed according to a 5-point scale (1 = *not at all;* 5 = *a*

great deal) and 4-point Likert scale (1 = *completely disagree;* 4 = *completely agree*). There was

also an open-ended question about students' experiences of using the Poetry Machine. A set of

statements in both questionnaires was designed to compare possible changes in students'

perceptions. Those statements were such as "A computer supports me in writing" / "The digital

tool (the Poetry Machine) supported me in writing a poem", "I can / I was able to express myself

by writing a poem". The open-ended questions in the questionnaires offered students an

opportunity to describe their idea about poetry before they used the Poetry Machine, and their

experience of writing with the support of the Poetry Machine after they had used it. These

questions were as follows: in the pre-questionnaire "Describe a poem by using 1 - 3 adjectives"

and in post-questionnaire "Describe in own words your experience of writing with the support of

the Poetry Machine." The questionnaires were collected using electronic surveys via Google

Forms. The students filled in the pre-questionnaire at the beginning of the first lesson and the

post-questionnaire at the end of the third lesson. The response rate was 97 %.

Teacher data. Teachers kept a diary of the lessons during the investigation. Their

instructions to the students and reflections were collected by email after the lessons in April

2017 and used to describe the context and the pedagogical design.

Data Analysis

Analysis from the log data: The number of poems and types of changes students

made. The number of poems produced and the number and types of changes to the poems

were calculated from the log data of the Poetry Machine. It provided a summary of user actions

for each poem which had been written with the Poetry Machine. The number of each type of

change was calculated from both those summaries and manually using Excel software. The log

data also provided information on the user ID of each writer and each poem. The number of

poems was calculated according to these.

Analysis of questionnaires about perceptions of writing poems. The quantitative

data arising from questionnaires were analyzed using descriptive statistics (Statistical Package

for the Social Sciences, SPSS 25 software). We conducted Pearson correlational analyses to

assess relationships between students' perceptions of enjoyment of literacy, the ability to write

different texts, perceptions of poetry, self-estimated interest in the subject, and grades in the

subject. Comparisons between the students' perceptions of poetry writing before and after using

the Poetry Machine were made using paired-samples t-test and Wilcoxon t-test. Comparisons

between the answers from male and female participants were made using independent samples

t-tests. Both the independent samples t-test and one-way ANOVA were conducted to find out

whether the students who wrote many poems had different perceptions of poems and writing.

The answers to the open questions in the questionnaires were analyzed by combining them into

three categories regarding the similarity of descriptive words. The categories were (a) positive

descriptive words (for example a poem is gentle and beautiful; writing with the support of the

Poetry Machine was fun and nice), (b) negative descriptive words (for example boring, hard,

and dull), and (c) answers without words (for example empty space).

Results

Results of the Students' Use of the Poetry Machine

The first research question framing this study was: *How do students use the Poetry*

Machine? In the following we present the number of poems written with the support of the

Poetry Machine per student, followed by the number and type of changes that the participants
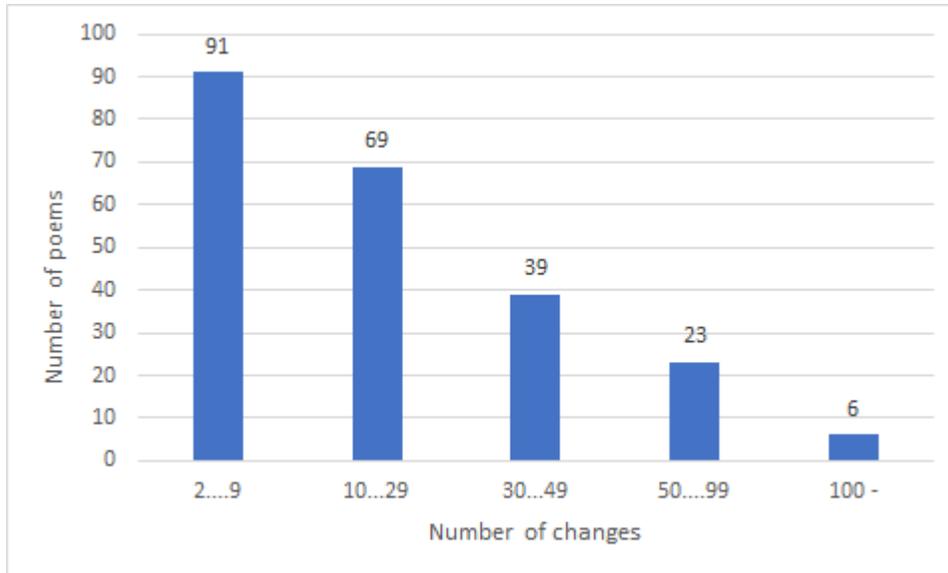
made to the poems.

The number of poems. The number of poems per user is depicted in Figure 2. The

participants wrote 228 poems. On average, they wrote 3.5 poems each. Eleven students, of

whom four were male, wrote more than five poems (6 - 11). A few students had forgotten their

usernames and took a new one, and therefore the number of users was higher (*N*=65) than the

number of the participants (*N*=61). Thus, the number of poems that those users wrote is lower

than it would otherwise have been. Per the results of the Pearson correlation tests, no

significant correlation was found between gender or grades in the Finnish language and

literature subject and the number of poems written.

Figure 2*: Number of poems per user*
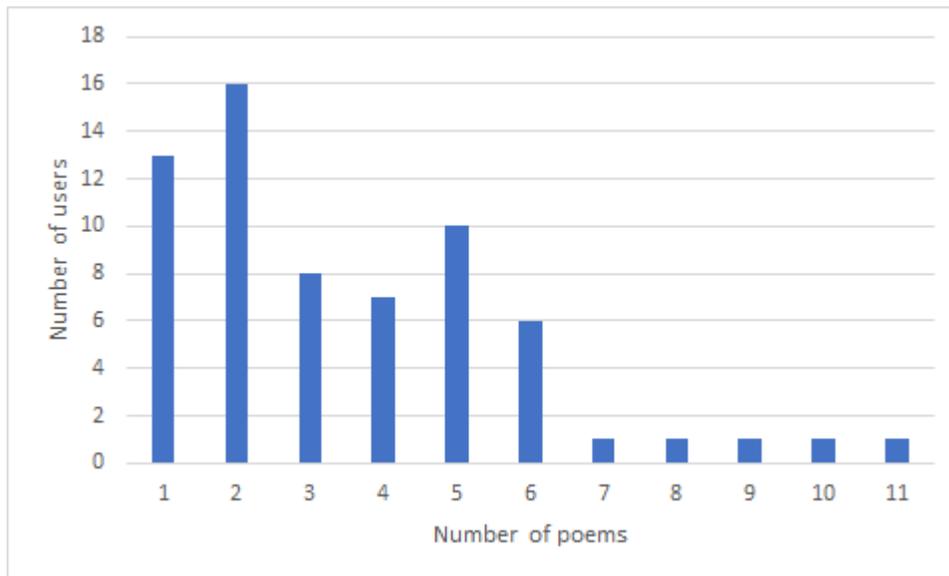
The changes made to the poems originally produced by the Poetry Machine. The

number of changes that the participants made to the poems varied from 2 to 125 per poem

(Figure 3). The mean number of changes was 24 per poem. For 60% of the poems, students

made 10 or more changes.

Figure 3: *The number of changes made to the poems during the writing process of each poem (f=228)*

The Poetry Machine offers several functions for editing poems (cf. chapter "Apparatus"). Figure 4 shows the relative frequencies of each type of change. The percentage of the different types of change was calculated from all the changes made to the poems. Thus, one poem could have numerous instances of words being moved, and each of these was calculated.

Figure 4: *Percentage of changes that students made to the poems*
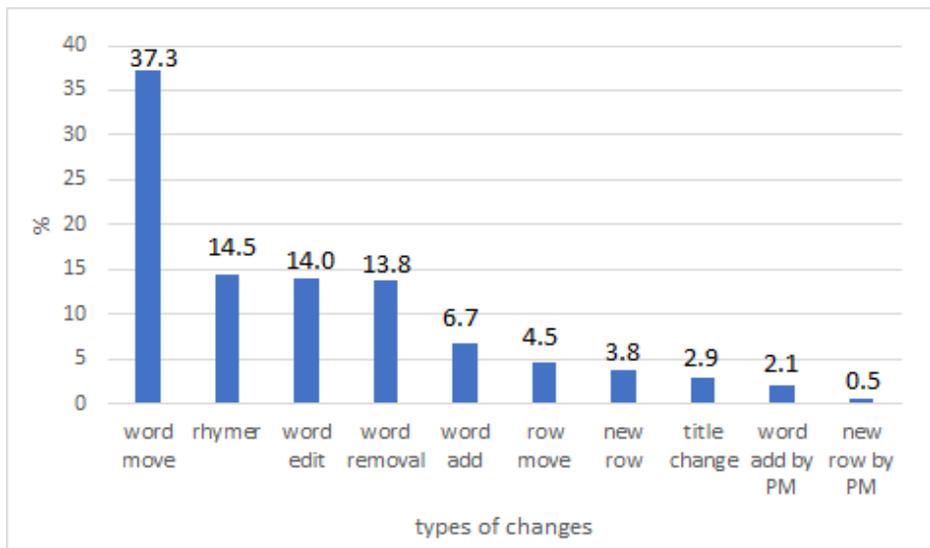
The most used operation was to move words (*37%* of all the changes). The students

also edited the suggested words. However, they seldom asked for new lines or words from the

Poetry Machine. They also asked the rhymer to assist them, but its suggestions were rarely

accepted in the final poems (not shown in the figures). The title was changed in *31%* of the

poems, which is an essential change that might provide a new meaning to a poem. In most

cases, the new title was shorter than the original, such as replacing "Mothers of your own" with

"Love". In some cases, the new title was more suitable to participants' own life, such as the

substitution of the title "Free airplanes" by "Mopeds are yes, but cars are the best".

The number of changes in students' poems varied extensively (2 - 125). One of the

students made 125 changes to a draft poem, and the final poem described the difficult process

of poetry writing. The draft poem was a nonsense poem about an airport interested in a bicycle.

The student moved words, added new words and lines, and finally, there was nothing left of the

original poem. (The poem has been translated from Finnish to English by the first author. In the

translation, some features of the original poem have been lost.)

I don't know what to do

because this is so difficult!

The teacher told me to produce a poem

and that is what I'm trying to do.

But the only thing in my head is food.

because I'm hungry!

The next three lessons we'll have handcraft arts

but this will not do.

Let's go on with this

go on, go on

This is still dull!

Does someone imagine

that I will survive

I can tell you straight that I won't!

I'm still thinking all the time

why am I doing this?

Students' Perceptions of Poems before Writing with the Poetry Machine

The second research question framing this study was two-fold: How does writing with the support of the Poetry Machine influence students' perceptions of poetry writing, and how do these perceptions differ according to students' perceptions of literacy, grades in the subject, and gender.

First, we have presented the results of the students' perceptions of poems and literacy and compared the results between perceptions of literacy, grades, and gender before writing with the Poetry Machine. We have then presented the results, and finally, we have compared the results before and after the writing process.

The first set of analyses examined students' perceptions of poetry and reading and writing other texts. Table 1 describes the evaluation responses regarding students' perceptions of enjoyment of reading, writing and poetry and Table 2 presents an evaluation of responses regarding students' opinions of poems and writing, and self-estimated ability to write poems and other texts before they used the Poetry Machine.

Table 1: *Means, and Standard Deviations of Students' Evaluation Responses Regarding Perceptions of Enjoyment of Reading Writing and Poetry*

Statement	M	SD
I enjoy reading.	3.2	1.1

I enjoy writing.	3.0	0.9
I understand poems.	2.8	0.9
I enjoy poems.	2.0	0.9
I write poems during free time.	1.4	0.7
I read poems during free time.	1.4	0.7

Note. 1=not at all, 2=little, 3=somewhat, 4=much, 5=a great deal

Table 2: *Means, and Standard Deviations of Students' Evaluation Responses Regarding*

Opinions of Poems and Writing and Abilities to Write

Statement	M	SD
I think a poem must not be too long.	2.9	1.1
I think that I can write stories.	2.7	0.9
I think I have good ideas in writing and composing a text.	2.6	0.9
I think that I can write essays.	2.6	1.0
I think that it is nice to interpret poems.	2.0	1.0
I think that I can write poems.	1.9	1.2

I think that a poem must not be too easy.	1.9	0.9
I think that it is fun to write poems.	1.7	0.9
I can express myself by writing a poem.	1.5	0.9

Note. 1=completely disagree, 2=slightly disagree, 3=slightly agree, 4=completely agree

The students reported that they enjoyed reading (*M=3.2*) and writing (*M=3.0*), but poems less so (M=2.0), and most of them did not read or write poems (*M=1.4*). Nor did the students think that writing a poem was easy or fun, or that they could write or interpret poems or express themselves by writing poems. They disagreed slightly with all those statements before they used the Poetry Machine.

The results of the Pearson correlation tests between students' perceptions of enjoyment of literacy, the ability to write different texts and the relationship to poetry are depicted in Table 3.

Table 3: *Correlations between Enjoyment of Reading and Writing, and Students' Self-Estimated Ability of Writing Different Texts, and Understanding Poems*

Statement	I enjoy reading.	I enjoy writing
I enjoy reading.	1.0	.510**
I enjoy poems	.258*	.385**
I write own poems.	.237	.337**
I can understand poems.	.354**	.402**

I read poems during my free time.	.188	.181
I think that I can write poems.	.118	.395**
I think I can write essays.	.299*	.291*
I think I can write stories.	.343**	.359**

Note. ** Correlation is significant at the 0.01 level (two-tailed)
* Correlation is significant at the 0.05 level (two-tailed)

According to the results of the Pearson correlation tests (Table 3), positive perceptions of both reading and writing correlated significantly with enjoyment of and understanding poems. Nevertheless, those who enjoyed reading thought that they could not write poems, although they reported an ability to write other texts. In contrast, the results showed that those students who reported enjoyment of writing thought that they could also write poems. In addition, they said that they write their own poems.

Results of correlation between students' perceptions and the grades in the subject.

According to the results of the Pearson correlation tests, significant correlations were observed between students' self-estimated interest in the Finnish language and literature subject and positive perceptions of reading ($r=.38; p=.003$), writing ($r=.44; p<.001$), and poems ($r=.27; p=.03$). Further analysis showed significant and positive correlations between the grade and students' self-estimated interest in the subject ($r=.60; p<.001$). However, even those students who were interested in the Finnish language and literature subject, and had higher grades in it, thought that they were unable to write poems. Nor did they read poems during their free time.

Differences between the perceptions of male and female participants. Further statistical tests (Independent Samples T-test) revealed statistically significant mean differences (MD) between the answers from male and female participants to the statements "I enjoy poems"

(*MD 0.6, t(55)=2.5; p=0.02),* "I read poems during my free time" (*MD= 0.6, t(55)=3.2; p=.002*), "It

is fun to write poems" (*MD 0.6, t(55)=2.5;p=0.014)*, and "It is nice to interpret poems" (*MD 0.8,*

t(55) = 3.2; p=.003). The results showed that male participants enjoyed poems more, read them

more during their free time, thought that poetry writing is somewhat fun and enjoyed interpreting

poems more than female participants did.

Students were also asked to describe a poem by using three adjectives. Despite the

earlier-mentioned dislike of poems, most of those adjectives (*63%*) were positive (such as *fun,*

gentle, beautiful), and *32%* of them could be negative (such as *difficult, boring)*. The rest of the

adjectives (*5%*) were about the length of a poem (*short*).

Students' Perceptions of Poems after Writing with the Poetry Machine

Results on students' perceptions from the post-questionnaire are presented next and

compared between the male and female participants, and the results of those who wrote more

poems and those who wrote fewer poems. As shown in Table 4, students reported that the

Poetry Machine and having the opportunity to edit poems assisted them much in writing. They

also considered that the Poetry Machine supported them somewhat in managing the process of

writing a poem, that the poems were superior with its support, and that writing was somewhat

fun.

The results of a series of Independent Samples T-tests (Table 4) revealed that there

were differences in means between male and female participants' evaluation responses

regarding the support of the Poetry Machine. The difference was statistically significant as

shown in Table 4.

Table 4 : *Means (M) and standard deviations (SD) of the students' evaluation responses*

regarding perceptions of the support of the Poetry Machine and differences between male and

female students' evaluation responses in the post-questionnaire

Statement	All	Female	Male	Independent Samples T-test	
				t(55)	Sig.
The Poetry Machine supported me to write a poem.[a]	3.7(1.1)	3.4(1.3)	4.2(0.8)	2.5	.02*
The option to edit a poem with support of the Poetry Machine supported me. [a]	3.5(1.2)	2.9(1.3)	3.7(1.1)	0.4	.67
The Poetry Machine supported to manage in writing a poem. [b]	3.4(1.3)	3.0(1.4)	3.9(0.8)	3.5	.001***
I think that the poem was superior with the support of the Poetry Machine. [b]	3.4(1.2)	3.1(1.2)	3.6(1.1)	1.8	.04*
A model of a poem supported me in writing a poem.[a]	3.2(1.3)	2.9(1.2)	3.6(1.3)	2.1	.04*
It was easy to begin to write, because I got words ready from the Poetry Machine.[a]	3.3(1.1)	3.1(1.2)	3.6(1.0)	1.5	.02*
The Poetry Machine supported me in choice of words.[a]	3.2(1.2)	3.0(1.2)	3.7(1.1)	3.0	.01*
The rhymer supported me in writing.[a]	3.1(1.3)	2.8(1.2)	3.7(1.2)	2.9	.01**
Writing poems with the support of the Poetry Machine was fun.[b]	2.8(0.9)	2.6(1.0)	3.1(1.0)	2.1	.04*
The option to get support from the Poetry Machine with the meter supported me in writing.[a]	2.6(1.3)	2.4(1.4)	3.1(1.2)	2.0	.06
I was able to express myself by writing a poem with the support of the Poetry Machine.	2.2(1.0)	2.0(1.0)	2.5(1.0)	2.1	.04*

Note. [a] 1=not at all, 2=little, 3=somewhat, 4=much, 5=great deal

[b] 1=completely disagree, 2=slightly disagree, 3=slightly agree, 4=completely agree

* $p < 0.05$ (two-tailed) ** $p < 0.01$ (two-tailed) ***$p < 0.001$ (two-tailed)

In the post-questionnaire, the Pearson correlation tests revealed that those who wrote more poems considered that the Poetry Machine had supported them in beginning to write a poem ($r=0.7, p=.017$) and in writing superior poems ($r= 0.67, p=.036$). The correlations were positive and statistically significant. Instead, those who wrote fewer poems reported that it did not support them to begin writing poems or writing superior poems. There were no other statistically significant correlations between the number of poems written and the answers in the post-questionnaire. T-tests also revealed that those who wrote more than five poems (6–11) with the Poetry Machine enjoyed writing ($M=3.6, SD=0.9$) and already understood poems ($M=3.5, SD=0.8$) before they wrote poems. Evaluation responses of those who wrote fewer poems were not as positive ($M=2.9, SD=0.9; M=2.7, SD=0.9$). The differences between the groups were statistically significant (enjoyment of writing: $t(59)=-2.6, p=0.01$, *two-tailed;* understanding poems*: $t(59)=-2.6, p=0.01$, two-tailed*). According to the one-way ANOVA test, the differences in evaluation responses between pre- and post-questionnaires were also statistically significant in the following statements: "I can express myself by writing poems" ($F(1, 60)=3.99, MS=3.25, p=.05$), "I think that it is fun to write poems" ($F(1, 60)=3.84, MS=3.84, p=.03$), "I think that it is nice to interpret poems" ($F(1, 60)=5.72, MS=5.69, p=.02$), and "I think that a poem must not be too easy" ($F(1, 60)=4.10, MS=4.91, p=.03$).

Comparison of Students' Perceptions before and after Writing with the Support of the Poetry Machine

We compared identical statements in the pre- and post-questionnaires aiming to study whether the participants perceived that the computer/Poetry Machine supported them in beginning to write a poem, to write it, to express themselves by writing a poem, and by offering

a model of a poem. The relationships between the answers to these statements were analyzed

by using paired-samples t-tests and tested by using the related samples Wilcoxon signed-rank

test, which confirmed that the differences between the responses were statistically significant

(significance level .05). As shown in Table 5, the results reveal that the Poetry Machine

supported students to begin to write and express themselves by writing poems.

Table 5: *Comparison of the Results of Paired Samples T-tests for the Same Statements in the*

Pre- and Post-questionnaires

Statement	Pre-questionnaire	Post-	Paired samples t-test	
	M(SD)	M(SD)	t	Sig.
It is/was easy to begin to write a poem.	1.6(.89)	3.0(.90)	t(47)=7.6	<.001**
I can/was able to express myself by writing a poem.	1.5(.89)	2.2(1.0)	t(56)=3.7	.001***
A model of a poem would support me in writing a poem.	3.1(1.2)	3.2(1.4)	t(55)=.24	.81
A computer/the Poetry Machine supports/supported me in writing.	3.9(1.3)	3.7(.15)	t(54)=.98	.33

Note. * p < 0.05 (two-tailed) ** p < 0.01 (two-tailed) ***p < 0.001 (two-tailed)

In the post-questionnaire, the participants had the opportunity to describe the

experiences of writing with the support of the Poetry Machine. Most of the words (*69%*)

described the experience as positive, such as nice, easy, fun, and creative. Only *14%* of the

description words were negative, such as dull and difficult, and *17%* of the answers could not be

considered either positive or negative, such as empty space.

Discussion

In this study, we investigated whether a digital tool supporting creative writing, the Poetry

Machine, assisted lower secondary students in the challenging task of poetry writing. The

Poetry Machine's role was one of assistive technology.

Developing Poems by Using the Poetry Machine like a Word Processor and as a Source of Ideas

The first research question sought to explore how students use the Poetry Machine. The students reported that the Poetry Machine and the capacity to revise poems assisted them much in writing. However, the students did not use all the options to develop poems with the support of it. Most of the changes made to the poems were those that could also be done by a word processor, that is, moving, editing, and adding words. This result may be partly explained by the participants being familiar with writing with word processors, and not having experience with intelligent features of digital tools, like suggestions for new words and lines, and even with meters and rhymes, as offered by the Poetry Machine. This finding is consistent with that of Ching (2018) who found in his study that students' routines had been shaped by the word processing software they were accustomed to using. In our study, another explanation is that the students considered the draft poems as affordances and as a source of ideas, words, and lines from which they revised the poems. There were also differences in the students' writing processes: some of them made few changes to the draft poems while others developed them a lot. The commitment to the writing task varied.

Responding to the first research question, it was found that the option to edit poems with the Poetry Machine supported students in writing poems, although they did not use its intelligent features. This study raises the need to have more opportunities for students to practice writing with digital tools with intelligent features.

Writing with the Support of the Poetry Machine influenced Students' Perceptions of writing Poems

The second research question sought to explore changes in students' perceptions of writing poems after they had used the digital Poetry Machine. Before the writing experience, the students reported that they enjoyed poems only a little, that most of them did not read or write

poems, and writing a poem was not easy or fun. These results reflect those of Fleming (1992),

Hawkins & Certo (2014) and Wilson (2007) who also found that poetry is feared and is

unpopular in schools, and students experience poetry writing as being difficult. After writing with

the Poetry Machine, the students reported that the draft poems the artificial intelligence -based

tool provided them with made it easier to begin and to write a poem, and supported them

somewhat in their writing process. This result seems to be consistent with studies by Certo

(2015) and Wilson (2007), who argued that offering models of poems provides students with

support in the potentially challenging task of finding structure and style in poetry. The writing

was also easy and fun for most of the students in our study. Thus, the Poetry Machine brought

enjoyment into writing. The writing was akin to playing with the digital tool and could be

considered more enjoyable than writing with pen and paper without the assistance of a digital

tool.

The second research question also sought to explore how students' perceptions differ

according to their perceptions of literacy, grades in the subject, and gender. Findings revealed

that those who wrote many poems with the Poetry Machine thought that it supported them to

begin or to write superior poems, whilst those who wrote fewer poems reported that it did not

support them in these competencies. On the other hand, those who wrote more poems had

more positive perceptions of poems and they had even written their own poems earlier.

Obviously, there are more challenges in learning to write poems even with support of digital

tools among those who do not enjoy reading, writing, or poetry.

In our study, we did not find a significant difference between students' perceptions of

the support of the Poetry Machine per their different grades in the Finnish language and

literature subject. It supported all the students equally, irrespective of their grade. This outcome

is contrary to that of Chong & Lee (2012) in their study of creative writing with the support of the

Storyworld application. They found that academically low-achieving students produced more

significant improvements than academically high-achieving students. However, it can be assumed that in our study, we could not find differences between perceptions per grades because of the relatively high grade achieved by most of the students.

One interesting finding was that the male adolescents thought that the Poetry Machine supported their poetry writing more than the female adolescents did. These results reflected those of Hawkins & Certo (2014) who found that it was possible to create an environment in which male students were willing to engage with poetry and results of Hanratty's investigation (2011), which argued that male students are at least as capable as female students to respond to the demands of poetry. Studies by Merisuo-Storm (2006) and Troia et al. (2013) have suggested that female students' writing abilities are better than male students' and gender influences on performance goal orientations. In our study, we found that with the support of digital tools we can narrow the gap between genders. An explanation for this could be that the male students like to use computers in learning and may also have liked the game-like interface of the Poetry Machine. This finding reflected that of Merisuo-Storm (2006) who suggested that the use of computers can motivate male students to write. Thus, with support of innovative digital tools and use of technology we could support especially male students' writing processes.

We can respond to the second research question that writing with the Poetry Machine influenced the participants' perceptions of writing poems so that contrary to their earlier perceptions, most of them thought that writing with the digital tool was easy and fun.

Limitations of the Present Study

A limitation of this study is that the study, as a case study, was conducted in only one school over a very short time, and the generalizability of the results is thus limited. Still, the authors believe that the findings can inform considerations about how tools like the Poetry Machine support students' poetry writing because the participated school followed the general

Finnish curriculum and students were committed to the investigated process. Furthermore, the results are related to teachers' high level of engagement in this study, and because almost all the students had good grades in Finnish language and literature. The results might have been different in another school.

The students did not use all the features of the Poetry Machine. The results could have been different if they had known more about the possible ways to develop their poems with the Poetry Machine. For this, they should have had a better introduction to the features of the Poetry Machine as a source of both new words and lines, and as an aid with the meter and rhymes of the poems. The number of specific actions, including moves and edits presented by the numbers in the log data, may also be greater than the number of truly completed operations under these names since the logging functionality also logs events that have not been completed. Therefore, a student opening a word to edit it, but then changing his/her mind, would be nevertheless logged as an edit by the system.

Furthermore, the questionnaire had some poetic concepts that the students apparently did not recognize. For example, they did not use the meter at all and did not accept the suggestions of the rhymer to their final poems. Nevertheless, they reported that both the meter and the rhymer supported them in writing somewhat. They may have misunderstood these concepts in the statements.

Conclusions and Future Prospects

Our findings may assist in understanding the challenges of learning poetry writing and use of digital tools to assist writing at school. The Poetry Machine provided the most support to those students who already enjoyed writing. It is possible that with a more extensive use of the artificial intelligence -based features of the digital tool, all of them could have benefited more from it.

Especially the male adolescents experience was that the digital tool supported them in writing. An explanation for this could be that the male students like to use computers in learning and may also have liked the game-like interface of the Poetry Machine. This finding reflected that of Merisuo-Storm (2006) who suggested that the use of computers can motivate male students to write. Thus, with support of innovative digital tools and use of technology we could support especially male students' writing processes.

Students' writing processes were creative to some extent, and many of the characteristics of a creative process (Sawyer, 2018) appeared: students' ideas emerged when engaged in the process; the tool had an essential role as a source of ideas offering affordances from which to start revising of the poems; the process was iterative, and it included experimentation, but there were also dead ends and failures.

The role of the Poetry Machine in students' poetry writing processes is interesting. It might have been a writing tool and an inspirer, but it also might have alienated students from the poems: the text was no longer only an outcome of the student and the personal connection was cut. This might have assisted the shyness or sensitivity of a personal outcome; now it was shared with the digital tool as a joint outcome.

In our study, the students also worked collaboratively in pairs and in groups discussing and peer reviewing each other's poems. All digital writing tools can be used online, but as well as the writing process, collaborative working could be done in online environments using collaborative digital tools when students draw on their collective strengths (Krishnan et al., 2018). Online tools can also be used to build the student's common discussion and for their part they could wake enthusiasm and creativity.

Digital tools, such as the Poetry Machine, offer opportunities to motivate students in online learning. However, the young students need support both in face-to-face and online

learning environments. Especially online learning requires good instruction from teachers, although in the preliminary results from the spring 2020 Finnish students did not report problems in their digital competence, when in many countries teaching and learning routines changed due to the pandemic and online education was temporarily substituted face-to-face teaching (KARVI, 2020; Moore-Adams et al., 2016). Ilomäki & Lakkala (2020) have found in their study that the students liked the online learning, but teachers' pedagogic solutions affect how the online teaching succeeds (see also KARVI, 2020).

In this study, we focused on the quantitative analysis of the students' poems. We found that the students' commitment to the writing processes varied and some of them made much more changes to the draft poems than others. In further investigations, it would also be relevant to consider the qualitative features and structures of the poems and changes students made to them, to develop a full picture of the use and usefulness of the Poetry Machine. It would also be relevant to consider poetry writing with support of other digital tools and collaboratively. Overall, the writing of poems is not only writing but enhancing creativity as well as thinking skills.

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Appendix A: The Prequestionnaire for the Participants

(translated from Finnish to English)

Answer to the following questions by selecting the alternative that best describes you as a

reader or an author.

(Scale in the statements 1 – 3 and 5 – 7: 1 = not at all; 2 = little; 3 = somewhat; 4 = much; 5

= a great deal; scale in the statements 4 and 8: 1=never; 2=rarely;

3=monthly;4=weekly;5=daily)

1. I enjoy reading.

2. I enjoy writing.

3. I enjoy poems.

4. I write own poems.

5. I can understand poems.

6. A computer supports me in writing.

7. A model of a poem would support me in writing a poem.

8. I read poems during free time.

9. I read during my free time (choose from the alternatives: magazines/comics/novels/other

books/internet articles)

Answer to the following statements according to whether you agree or disagree them.

(Scale in all statements: 1=completely disagree; 2=slightly disagree; 3=slightly agree;

4=completely agree)

10. I think that I can write poems.

11. I think I can write essays.

12. I think I can write stories.

13. I think that it is easy to start to write a poem.

14. I think I have good ideas in writing and composing a text.

15. It is easy to start to write a poem.

16. I can express myself by writing poems.

17. I think that it is fun to write poems.

18. I think it is more fun to write together than writing alone.

19. I think that a poem must have rhymes.

20. I think a poem must not be too long.

21. I think that it is nice to interpret poems.

22. I think that a poem must not be too easy.

23. Describe freely a poem by 1 - 3 adjectives.

Background questions

1. Gender

2. Age

3. The grade of Finnish language and literature in last school report

4. Estimate your interest for studying Finnish language and literature

5. Estimate your grade of computing skills by scale from 4 to 10

APPENDIX B: The Post-questionnaire for the Participants

(translated from Finnish to English)

Instruction: Answer to the following statements by selecting an alternative that best describes

your opinions and experiences.   (Scale in all statements: 1 = not at all; 2 = little; 3 =

somewhat; 4 = much; 5 = a great deal)

1. The digital tool (the Poetry Machine) helped me in writing a poem.

2. A model of a poem supported me in writing a poem.

3. The possible to edit a poem (with the PM) supported me in writing.

4. The rhymer supported me in writing.

5. The possibility to get support from the Poetry Machine with the meter supported me in writing.

6. It was easy to start to write, because I got words ready from the Poetry Machine.

7. The Poetry Machine supported in choice of words.

Instruction: Answer to the following statements according to whether you agree or disagree.

(Scale in all statements: 1=completely disagree; 2=slightly disagree; 3=slightly agree;

4=completely agree)

8. It was easy to start to write a poem with support of the Poetry Machine.

9. I was able to express myself by writing a poem with the support of the Poetry Machine.

10. The Poetry Machine supported to manage the writing of a poem.

11. I think that the poem was superior with the support the Poetry Machine.

12. Writing poems with the support of the Poetry Machine was funny.

13. How did the use of the Poetry Machine influence to your opinion of poetry?

14. Describe by own words your experience of writing with the support of the Poetry Machine.

Background questions

1. Gender

2. Age

3. The grade of Finnish language and literature in last school report

4. Estimate your interest for studying Finnish language and literature

5. Estimate your grade of computing skills by scale from 4 to 10