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**Promoting Pro-environmental Printing Behavior: The Role of ICT Barriers  
and Sustainable Values**

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**ABSTRACT**

This study aims to explore how to reduce printing at elementary schools through strengthening both the effective use of ICT and pro-environmental values. Literature review is presented in themes – ICT barriers (fears, knowledge, skills and time), demographic, printing behavior and sustainable values (egoistic, hedonic, prosocial & biospheric). A quantitative method is applied in this study, data is obtained from 108 teachers from seven elementary schools at three different regions in Northwest Friesland, The Netherlands by using a questionnaire. The value scale by De Groot and Steg (2008) is applied for sustainable values while for ICT barriers and printing behavior, questions are developed by the author and validated by Cronbach. The main findings illustrate that lower ICT fears and higher biospheric values have a positive effect on the pro-environmental printing behavior. To minimize teachers' ICT fears and printing, directors of the schools should train teachers in the use of ICT and enhance their biospheric values. This study is one of the first to explore ICT barriers with the combination of pro-environmental values orientation contributing pragmatic evidence to reducing financial and environmental costs.

**Keywords**

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ICT integration,  
onscreen reading,  
green printing,  
pro-environmental behavior,  
Sustainability and ICT  
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**INTRODUCTION**

The omnipresent nature of Information Communication Technology (ICT) has altered almost every feature of life and radically changed how people live, work and play (Kozma, 2005). As a chunk of that makeover, it has become indispensable to extensively use ICT in elementary schools' classrooms, as elementary schools prepare students for living in contemporary society. To accomplish this provision, schools need to integrate ICT in classrooms. Although, there is numerous research about ICT at schools (Korte & Husing, 2007; Lim & Khine, 2006; Watt, 1980; Yelland, 2001), there are very limited studies focusing on pro-environmental printing behavior with the combination of effective use of ICT and hence, the intention of this study to explore ICT and teachers' sustainable values from this angle in the elementary schools. Previous studies prove that onscreen reading can reduce 45% paper use (Kutami, 2009) there is a lack of research on using ICT to lower printing in combination with enhancing teachers' pro-environmental values. This paper emphasizes that deficit and uses De Groot and Steg's (2008) value scale to find out teachers' pro-environmental values orientation such as egoistic, hedonic, prosocial and biospheric.

This study is under taken at seven different elementary schools in Northwest Friesland, The Netherlands. ICT is regularly operated within the schools, but it is not often completely exploited. One possible reason for this is the lack of ICT integration in general and as a substitute for printing in particular. The schools are well-equipped with modern equipment that is updated on a fairly regular basis. Nevertheless, this does not, in itself, guarantee ICT integration in education. Other features, such as fears, knowledge, time, skills and pro-environmental values of teachers also play a vital role. Furthermore, the value and benefits of ICT integration need to be understood by teachers and thus, there is no point in showing teachers in what way to integrate ICT in their work if the reason for doing so is not understood by them (Veen, 1993).

There have been limited chances for teachers for professional development in relation to ICT. Hence, it can be concluded that their knowledge of ICT is limited and this may cause fear and avoidance of use of ICT (Tsai, 2012; Andoh, 2012). Furthermore, several studies also emphasize that there are a number of factors or barriers

such as fear of making mistakes, reluctance, personal fundamental, pedagogics and technology beliefs, ICT integration, frustration, ICT skills, ICT Knowledge, lack of competence, insufficient time and outdated computers that hinder the successful integration of ICT in education.

### Research Questions

Considering the aforementioned facts the central questions of this study follows:

**Q1:** What are the barriers of using ICT by elementary school teachers in general and as an alternative for printing in particular?

**Q2:** What is the influence of barriers on the effective use of ICT in the context of reducing printing?

**Q3:** What are the effects of pro-environmental values in reducing printing?

To test this notion, the following hypotheses are used:

**H1:** *The higher teachers' pro-environmental values, the higher the reduction of environmental and financial costs at elementary schools measured as use of paper.*

**H2:** *The lower teachers' barriers towards ICT, the lower the use of paper.*

**H3:** *The lower ICT barriers and the higher pro-environmental values, the lower the environmental and financial costs at school measured in use of paper.*

### Review of Literature

The focus of this literature review is on the main themes of this study ICT barriers (fears, skills, knowledge and time) and pro-environmental values (egoistic, hedonic, prosocial and biospheric).

#### Fears

Anxiety, lack of confidence and fear often indicates that ICT takes a back seat to conventional learning mechanisms (Russell & Bradley, 1997). ICT is significantly under-used by teachers and the problem is worldwide (Murphy & Greenwood, 2006). Many explanations are offered such as fear of making mistakes, lack of resources or lack of access to resources in schools, outdated computers and reluctance to use ICT (Lim & Khine, 2006). In other studies where teachers have been surveyed, similar fears have been articulated (Daugherty & Funke, 1998; Hare & McCarten, 1996; James & Beattie, 1996; Mudge, 1999; Schifter, 2000; Thompson & Holt, 1996; Wolcott & Betts, 1999). This paper discovers the fears the teachers have towards ICT. In addition, do these fears have an influence on printing behavior?

#### Skills

A series of statements that identified potential teachers' barriers to the use of technology is shown in Table 3 (Pajo & Wallace, 2001). Likewise, other significant barriers included lack of skills, technical support, short training, insufficient funds and insufficient teaching support. The perception of the institution not recognizing nor rewarding efforts to integrate ICT into teaching were all acknowledged as main barriers. Additionally, a personal dislike of computers was specified by a few (Pajo & Wallace, 2001). In view of this literature review, this study explores – the influence of ICT skills on printing behavior.

#### Knowledge

Teachers' beliefs about teaching and learning with ICT are central to integration (Mumtaz, 2000). Above all, if the software matched the teacher's pedagogy, it will be used by them (Veen, 1993). Dealing effectively with ICT relates not only to the knowledge of the capability, limitations, applications and implications of ICT, but also to individuals' personal and fundamental belief (*pedagogics and technology belief*). Additionally, "Technology integration in education is not simply as a state of "technology", rather, it becomes a state of "art" (Tsai (2012, p.1059), meaning teachers' need to redesign their thinking, learning material and activities since in classroom context students are quite dynamic (Tsai, 2012). Therefore, this study explores whether ICT knowledge influences printing behavior.

#### Time

The time issue plays a vital role and is, thus, a significant barrier. It was acknowledged by Pajo and Wallace (2001) that learning technology consumes time. Similarly, it was also felt by a large number of respondents that the time connected with emerging and applying courses posed a real disorder to their use of ICT in teaching (Pajo & Wallace, 2001). For that reason, this study finds out - do teachers get sufficient time to use the computer during lessons?

In conclusion, keeping abovementioned literature review in view, teachers' fear, skills, knowledge and time are important factors for ICT integration and are the focus of this paper as well.

### **Role of sustainable values**

As emphasized by De Groot and Steg (2008), values are desirable goals that serve as guiding principles in people's life. The aim of the research is to measure and enhance both the teachers' pro-environmental values and pro-environmental approach towards ICT (Cuban, 2000; Andoh, 2012; Korte & Husing, 2007; Watt, 1980 & Kutami, 2009); as the teachers' approach has an impact on the environment. Behavioral interventions are generally being more effective when they are steadily planned, applied and evaluated (Steg & Vlek, 2008). Values determine what people attend to and how people evaluate various aspects of the situation and what alternatives are being considered (De Groot & Steg, 2008). There are four types of values - hedonic, egoistic, prosocial, and biospheric values (De Groot & Steg, 2008). In this study De Groot and Steg's (2008) value scale is used to measure these four values.

### **Egoistic**

As maintained by De Groot and Steg (2008), individuals who have a predominant approach from egoistic values, will think over costs and benefits of environmentally substantial personal behavior: Once the apparent compensations surpass the apparent expenses, they will have an ecologically friendly goal (De Groot & Steg, 2008).

### **Hedonic**

The individual with hedonic values acts spontaneously to fulfill the pleasurable feeling of that moment. It appeared to be more strongly and negatively related to environmental beliefs, preferences, norms, and actions (De Groot & Steg, 2008).

### **Prosocial**

Prosocial individuals are those with altruistic value approach who will form their choice to behave pro-environmentally or not, on apparent costs and benefits for other individuals (De Groot & Steg, 2008).

### **Biospheric**

Individuals with a biospheric value approach will primarily form their choice to act pro-environmentally or not, on the apparent costs and benefits for the environment and planet all together (De Groot & Steg, 2008). Considering the aforementioned literature review, this study discovers: do pro-environmental values influence printing?

In conclusion, literature review highlights that ICT integration in elementary schools is indispensable. In addition, due to these barriers teachers are reluctant to use the computer at schools. Furthermore, the role of ICT in reducing paper is underlined showing that an appropriate use of ICT, schools can reduce environmental and financial costs. Finally, existing research reveals that values are desirable goals that serve as guiding principles in people's lives (De Groot & Steg, 2008).

### **Research Method**

In this study, a pre-coded questionnaire is the instrument used to gather data. To explore teachers' pro-environmental values orientation, de Groot and Steg's (2008) value scale is used. While for ICT barriers (fears, skills, knowledge & time) and printing behavior, questions are developed by the author on the basis of the literature discussed in the literature review by using Likert scale ranging from never (1) to always (6). At the end of the questionnaire, demographic features such as age, gender and teaching experience are measured with the aim to understand respondents' profile. The population of this research is elementary school teachers ranging from 20 to 65 years old, male and female with teaching experience of less than 5 years to more than 25 years.

The population size of this study is 108 teachers i.e. the whole amount of teachers working for seven different elementary schools. Therefore 108 questionnaires were sent, and 82 questionnaires were returned which is a response of 76%. As Cohen *et al* (2000) proclaims, the response rate which is between 40% and 50% is adequate. A total of 18% per cent of the respondents were male and 82% percent female which indicates a real picture of elementary schools under observation and in general all over The Netherlands (CBS report, 2012). Moreover, 69% teachers were above 40 and only 11% were younger than 30 years indicating there are more elderly staff in the elementary schools which is also in line with the population of the schools (CBS report, 2012). Besides, 83% teachers had more than 10 years' experience, whereas, only 5% had less than 5 years' experience which demonstrates young teachers as undersized in the elementary schools (see Table 1).

**Table 1: Teacher Demographics (N = 82)**

		<b>N</b>	<b>Percent</b>
<b>Gender</b>	Male	15	18.3%
	Female	67	81.7%
<b>Age</b>		<b>N</b>	<b>Percent</b>
	20-30	9	11.0%
	30-40	17	21.0%
	40-50	17	21.0%
	50-60	36	44.0%
	60-70	3	4.0%
<b>Teaching Exp.</b>		<b>N</b>	<b>Percent</b>
	0-5	4	5,00
	5-10	10	12.0%
	10-15	16	20.0%
	15-25	19	23.0%
	25-above	33	40.0%

### Findings

Results of this study are as follows:

### Fears

The ICT fears of teachers are assessed with six different questions (Table 2). Grand mean and standard deviation of the fear is (Mean = 2,31, SD. 0,87). Moreover, "I am lacking ICT training" is the greatest fear among teachers (Mean = 2,77, SD. 1,16). In contrast, the lowest fear is "I dislike computer technology in teaching" (Mean = 1,96, SD, 1,24).

**Table 2: Cronbach, Mean and Standard deviation for ICT fears (N = 82)**

<b>Items</b>	<b>Cronbach</b>	<b>Mean</b>	<b>SD.</b>
<b>Fears</b>	<b>(<math>\alpha = .85</math>)</b>		
I am lacking ICT training.		2,77	1,16
I am afraid to make mistakes.		2,56	1,29
Use of computers during teaching causes me stress.		2,38	1,10
I am afraid the computer will take over the classic teaching method.		2,10	1,26
I am reluctant to use computers.		2,07	1,08
I dislike computer technology in teaching.		1,96	1,02

### Skills

ICT skills among teachers are assessed with twelve different questions (Table 3). Grand mean and standard deviation of the skills is (Mean = 4,28, SD. ,84). Moreover, use of email, printer and computer are among the top three, namely, (Mean = 5,93, SD. = ,31; Mean = 5,82, SD. = ,59; Mean = 5,80, SD. = ,69), whereas, drop box, tablet and google docs. are among the last three, namely, (Mean = 1,96, SD. 1,67; Mean = 2,90, SD. = 2,21; Mean = 3,17, SD. = 2,24). This shows that teachers have better skills in using email, printer and computer; however, they need more skills for using Drop Box, tablet and google docs.

**Table 3: Cronbach, Mean and Standard deviation for ICT Skills (N = 82)**

<b>Items</b>	<b>Cronbach</b>	<b>Mean</b>	<b>SD.</b>
<b>Skills</b>	<b>(<math>\alpha = .73</math>)</b>		
Email		5,93	,31
Printer		5,82	,59
Computer		5,80	,69
Digital Board		5,13	1,55
Microsoft Office		5,04	1,62
Digital Camera		4,55	1,63
Laptop		4,38	2,00
Smart phone		3,55	2,32
Scanner		3,18	1,87
Google Docs.		3,17	2,24
Tablet		2,90	2,21
Drop Box		1,96	1,67

### Knowledge

The teacher's ICT knowledge is assessed with four different questions (Table 4). Grand mean and standard deviation of the knowledge is (Mean = 4,11, SD. 1,00). Moreover, "I help pupils when they have a problem with computer" scores better (Mean = 4,47, SD. = 1,28), while, "I feel I have sufficient knowledge about ICT" scores minimum (M = 3,73, SD. 1,16) which shows teachers are more confident about their ICT knowledge when it comes to helping pupils; however, they are less confident when it comes to "I feel I have sufficient knowledge about ICT".

**Table 4: Cronbach, Mean and Standard deviation for ICT knowledge (N = 82)**

Items	Cronbach	Mean	SD.
<b>Knowledge</b>	<b>(<math>\alpha = .75</math>)</b>		
I help pupils when they have a problem with computer.		4,47	1,28
Lack of knowledge about hardware make me nervous.		4,17	1,41
Lack of knowledge about software make me nervous.		4,05	1,45
I feel I have sufficient knowledge about ICT.		3,73	1,16

### Time

Respondents are asked five queries about time (Table 5). Grand mean and standard deviation of the time is (Mean = 3,38, SD. ,73). Moreover, "I get sufficient time to prepare my lesson" is the greatest time barrier the teachers face (Mean = 4.05, SD. = 1,30); however, "I do not use computers as they are very outdated" scored least (M = 1,54, SD. ,90) indicating the outdated computer as having a less important role for the teachers' time barrier. Cronbach Alpha of teacher time barrier is ( $\alpha = 0,52$ ) which is very low. To get the higher Cronbach value, the author has decided to delete item 4 "More ICT support will motivate me to use more computers in the class." and 5 "I do not use computers as they are very outdated" respectively. After deleting these two items, Cronbach Alpha of teachers time barrier is ( $\alpha = 0,77$ ) which is showing a good fit of three items to this construct. Hence, it has been decided by the author to keep three items for further analysis.

**Table 5: Cronbach, Mean and Standard deviation for ICT time (N = 82)**

Items	Cronbach	Mean	SD.
<b>Time</b>	<b>(<math>\alpha = .77</math>)</b>		
I get sufficient time to prepare my lesson		4,05	1,30
I have adequate time to use computer in the class		3,95	1,40
I have enough time to use computer during my lesson every day.		3,69	1,15

### Printing Behavior

Teachers' printing behavior. Respondents are asked six different questions (Table 6). Grand mean and standard deviation of the printing behavior is (Mean = 4,27, SD. ,70). Moreover, "I read my documents digitally" (Mean = 4,55, SD. = 1,19) stands out. However, the results of rest of five questions are very close to each other. Cronbach Alpha of teacher's printing behavior is ( $\alpha = 0,60$ ). To get a higher Cronbach values, the author has decided to delete item 2 "Before I print I first see the print view." And item 7 "I print directly from my mail". After deleting these two items, Cronbach Alpha of teachers printing behavior is ( $\alpha = 0,73$ ) which shows a good fit of six items to this construct.

**Table 6: Cronbach, Mean and Standard deviation for printing behavior (N = 82)**

Items	Cronbach	Mean	SD.
<b>Printing Behavior</b>	<b>(<math>\alpha = .73</math>)</b>		
I read my documents digitally.		4,55	1,19
Green printing is my priority.		4,46	1,27
I print single sided		4,28	1,41
I am careful about printing my documents.		4,20	1,68
I print double sided.		4,11	1,61
I think for the environment before I print my documents.		4,00	1,23

### Egoistic Values

Respondents are asked five different questions (Table 7) by using De Groot and Steg's (2008) value scale ranging from against my principle (-1) to extremely important (7). Grand mean and standard deviation of the egoistic values is (Mean = 2,93, SD. 1,02). Moreover, "AMBITIOUS: hardworking, ambitious, aspiring" (Mean =

4,19, SD.= 1,64) are among significant scores while “INFLUENTIAL: having an impact on people and events” (Mean = 3,64, SD.= 1,56) score significantly as well. However, “POWER: control over others, dominance” (Mean = 1,15, SD.= 1,32) scores less. The results indicate that teachers with AMBITIOUS and INFLUENTIAL characteristics have higher egoistic values.

**Table 7: Cronbach, Mean and Standard deviation for egoistic values (N = 82)**

Items	Cronbach	Mean	SD.
<b>Egoistic Values</b>	<b>(<math>\alpha = .73</math>)</b>		
AMBITIOUS: hardworking, ambitious, aspiring		4,19	1,64
INFLUENTIAL: having an impact on people and events		3,64	1,56
WEALTH: material possessions, money		3,09	1,38
AUTHORITY: the right to lead or command		2,59	1,47
POWER: control over others, dominance		1,15	1,32

### Hedonic Values

Respondent are asked three different questions (Table 8) by using De Groot and Steg’s (2008) value scale. Grand mean and standard deviation of the hedonic values is (Mean = 5,14, SD. 1,10). Moreover “ENJOYING LIFE: food, sex, entertainment, etc.” (Mean = 5,59, SD.= 1,34) are among significant scores.

**Table 8: Cronbach, Mean and Standard deviation for hedonic values (N = 82)**

Items	Cronbach	Mean	SD.
<b>Hedonic Values</b>	<b>(<math>\alpha = .70</math>)</b>		
ENJOYING LIFE: food, sex, entertainment, etc.		5,59	1,34
HAPPINESS: enjoyment, fulfillment of desires		4,95	1,52
PAMPER YOURSELF: doing pleasant things		4,86	1,37

### Prosocial Values

Respondent are asked four different questions (Table 9) by using De Groot and Steg’s (2008) value scale. Grand mean and standard deviation of the prosocial values is (Mean = 6,12, SD. 0,73). Moreover, “A PEACEFUL WORLD: free of war and conflict” (Mean = 6,49, SD.= 0,79) is among significant scores. Nevertheless, the means of all items are high which indicate teachers’ positive prosocial values.

**Table 9: Cronbach, Mean and Standard deviation for prosocial values (N = 82)**

Items	Cronbach	Mean	SD.
<b>Prosocial Values</b>	<b>(<math>\alpha = .73</math>)</b>		
A PEACEFUL WORLD: free of war and conflict		6,49	,79
EQUALITY: equal opportunities for all		6,26	,85
SOCIAL JUSTICE: correcting injustice, care for the weak.		6,09	1,06
HELPFULNESS: working for the welfare of others		5,65	1,15

### Biospheric Values

Respondents are asked four different questions (Table 10) by using De Groot and Steg’s (2008) value scale. Grand mean and standard deviation of the biospheric values is (Mean = 5,52, SD. 1,01). Moreover, “RESPECT FOR THE EARTH: live in harmony with other species” (Mean = 6,07, SD.=1,03) are among significant scores.

**Table 10: Cronbach, Mean and Standard deviation for biospheric values (N = 82)**

Items	Cronbach	Mean	SD.
<b>Biospheric Values</b>	<b>(<math>\alpha = .84</math>)</b>		
RESPECT FOR THE EARTH: live in harmony with other species		6,07	1,03
ENVIRONMENTAL PROTECTION: preserving nature		5,49	1,21
POLLUTION PREVENTION: protecting natural resources		5,44	1,21
UNITY WITH NATURE: fitting into nature		5,09	1,44

### ANOVA Test

The ANOVA is conducted to compare, first of all, the effect of demographic aspects such as gender, age and teaching experience on ICT barriers such as fear, skills, knowledge, time and printing behavior. Afterwards, the effect of demographic aspects on the value orientations such as egoistic, hedonic, prosocial and biospheric are measured. The significance is tested at the  $p < 0.05$  level for all computation.

### Male teachers have lower ICT fears and higher ICT knowledge than female teachers

Table 11 shows a significant difference of ICT fear and knowledge between genders. On the one hand, ICT fears for men ( $M = 1,76$ ,  $S.D. = .89$ ) are less than for women ( $M = 2.43$ ,  $S.D. = .82$ ), [ $F(1,80) = 7,99$ ,  $p = .01$ ] which means male teachers have less ICT barriers than their counter part female. On the other hand, ICT knowledge for men ( $M = 5,00$ ,  $S.D. = .75$ ) is higher than for women ( $M = 3.91$ ,  $S.D. = .94$ ), [ $F(1,80) = 17,46$ ,  $p = .00$ ] which indicates male teachers as having more ICT knowledge than female teachers. Though male teachers' ICT skills and time was better than female teachers, it is non-significant.

**Table 11: Comparing Gender with ICT barriers (fear, skills, knowledge, time) and printing behavior**

	Gender	N	Mean	SD.	F
Fears	Male	15	1,76	,89	F (1,80) =7,99, p = ,01
	Female	67	2,43	,82	
Skills	Male	15	4,57	,85	F (1,80) =2,17, p = ,15
	Female	67	4,22	,83	
Knowledge	Male	15	5,00	,75	F (1,80) =17,46, p = ,00
	Female	67	3,91	,94	
Time	Male	14	4,02	1,10	F (1,78) =,24, p = ,62
	Female	66	3,86	1,10	
Printing Behavior	Male	15	4,25	,78	F (1,80) =,00, p = ,96
	Female	67	4,31	,76	

P <0,05

### Younger teachers have higher egoistic and hedonic values orientation and lower prosocial and biospheric values orientation than older teachers

**Table 12: Comparing Age with value orientations (egoistic, hedonic, prosocial and biospheric values)**

	Age	N	Mean	SD.	F
Ego. Values	20-30	9	3.53	1.46	F (4,76) =2,61, p = ,04
	30-40	17	3.35	1.22	
	40-50	17	2.80	.97	
	50-60	35	2.70	.69	
	60-70	3	2.20	.72	
Hed. Values	20-30	9	5.44	.87	F (4,76) =4,17, p = ,00
	30-40	17	5.90	.92	
	40-50	17	4.63	.75	
	50-60	35	4.98	1.15	
	60-70	3	4.56	1.39	
Soc. Values	20-30	9	5.86	.67	F (4,76) =2,53, p = ,04
	30-40	17	6.02	.73	
	40-50	17	5.82	.82	
	50-60	35	6.32	.64	
	60-70	3	6.75	.43	
Bio. Values	20-30	9	5.00	1.05	F (4,76) =3,96, p = ,00
	30-40	17	5.08	.99	
	40-50	17	5.30	1.04	
	50-60	35	5.89	.85	
	60-70	3	6.50	.50	

P <0,05

Table 12 indicates the effect of age on the value orientations such as egoistic values, hedonic values, prosocial values and biospheric values. Results reveal that younger teachers with the age group 20-30 ( $M = 3,53$ ,  $S.D. = 1,46$ ) have higher egoistic values than teachers with the age group of 40-50 ( $M = 2,80$ ,  $S.D. = ,97$ ), 50-60 ( $M = 2,70$ ,

S.D. = ,69) and 60-70 (M = 2,20, S.D. = ,72) which is significant at  $p < ,04$  indicating younger teachers to be more self-centered than older teachers. Furthermore, hedonic values result reveals that younger teachers with the age group 20-30 (M = 5,44, S.D. = ,87) have higher hedonic values than teachers with the age group 60-70 (M = 4,56, S.D. = 1,39) which is significant at  $p < ,00$  indicating younger teachers to be more conceited than older teachers. Younger teachers' values are more aligned with "Care for me" (Cavagnaro & Curiel, 2012). On the other hand, prosocial values result reveals that younger teachers with the age group of 20-30 have lower prosocial values (M = 5,86, S.D. = ,68) than teachers with the age group of 50-60 (M = 6,32, S.D. = ,64) and 60-70 (M = 6,75, S.D. = ,43) which indicates that older teachers are having more prosocial approach by caring for the other as well which is in line with Cavagnaro and Curiel's (2012) theory "Care for me and you". Moreover, younger teachers with the age group of 20-30 have lower biospheric values (M = 5,00, S.D. = 1,05) than teachers with the age group of 50-60 (M = 5,89, S.D. = ,85), and 60-70 (M = 6,50, S.D. = ,50) showing younger teachers to have less pro-environmental values than older teachers. This means older teachers have more biospheric values than younger teachers which is aligned with Cavagnaro and Curiel's (2012) theory of three levels of sustainability "care for all".

### Correlation Matrix

The correlation matrix explains many relations but only significant correlation between variables and pro-environmental printing behavior are highlighted. First of all, table 13 indicates that there is a significant relation between fears and pro-environmental printing behavior ( $r = -0.22$ ,  $p = 0,04$ ) where the significant level is  $p < 0,05$  which means if teachers' ICT fears are lower, then they have higher pro-environmental printing behavior. Secondly, biospheric value orientation of teachers have significant relation at  $p < ,001$  with pro-environmental printing behavior ( $r = 0,36$ ,  $p = 0,001$ ) which means teachers' higher pro-environmental values have positive influence on pro-environmental printing behavior thus leading to higher pro-environmental printing.

**Table 13: Correlation and reliabilities of study variable (N = 82)**

Variable	1	2	3	4	5	6	7	8	9	10	11
1. Age											
2. Gender	,75										
3. Teaching Exp.	,00**	,60									
4. Fears	,00**	,01**	,01*								
5. Skills	,01**	,15	,01*	,00**							
6. Know.	,02*	,00**	,06	,00**	,00**						
7. Time	,76	,62	,96	,44	,41	,51					
8. Ego value	,00**	,26	,01**	,01*	,00**	,44	,32				
9. Hedonic values	,01*	,33	,02*	,61	,85	,67	,39	,01**			
10. Prosocial values	,01*	,74	,01**	,54	,35	,68	,99	,76	,11		
11. Biospheric value	,00**	,75	,00**	,70	,73	,99	,26	,14	,26	,00**	
12. Print Behavior	,56	,96	,29	,04*	,06	,45	,14	,03*	,39	,11	,00**

Note: \*  $p < ,05$ ; \*\*  $p < ,01$ , Cronbach alphas for scaled variables: Fears = ,85, Skills = ,73, Knowledge = ,75, Time = ,77, Ego. values = ,73, Hed. values = ,70, Prosocial values = ,73, Bio values = ,84 and Printing behavior = ,73

Looking at the outcomes of the correlation analysis, it can be suggested that teachers' biospheric value orientation has positive influence on the pro-environmental printing behavior as well as teachers' ICT fears and skills have a marginally positive influence on the pro-environmental printing behavior at elementary school.

### Regression analyses

The regression analysis is conducted to find out the casual relationship between dependent variable like printing behavior and other independent variable such as ICT barriers (fears, skills, knowledge & time) and values orientation such as biospheric, prosocial, egoistic and hedonic.

**Hypothesis one:** *Teachers' higher pro-environmental values orientation enhances higher pro-environmental printing behavior at elementary schools.*

Table 14 presents the model summary of value orientations such as egoistic and biospheric values (independent variable) and the printing behavior (dependent variable) since only these two values have correlation with printing

behavior that is why regression analysis is conducted only for these two items. where p values for the teachers' biospheric values ( $p < 0,01$ ) is significant. The results of the regression analysis reveals that only biospheric values are the significant factor to influence pro-environmental printing behavior. Hence, the hypothesis is supported.

**Table 14: Regression test between value orientation and printing behavior**

	$\beta$	t	$R^2$	Adjusted $R^2$	df	F
Printing Behavior			,17	,14	2,78	(7.75) = .01*
Egoistic	,19	1,79				
Biospheric	,33	3,16*				

Dependent Variable: Printing behavior, \* $p < 0,05$

**Hypothesis two:** *Teachers' lower barriers towards ICT enhances higher pro-environmental printing behavior at elementary school.*

Table 15 presents the model summary for ICT barriers such as fears (independent variable) and the printing behavior (dependent variable). Only 5% variation in the pro-environmental printing behavior can be explained through ICT barriers such as fears, skills, knowledge and time  $F(4,13) = 0,04$ ,  $r^2 = 0,04$ . It indicates teachers' ICT fears as a marginal factor to influence the pro-environmental printing behavior. Hence, the hypothesis is partly supported.

**Table 15: Regression test between ICT barriers and printing behavior**

	$\beta$	t	$R^2$	Adjusted $R^2$	df	F
Printing Behavior			,05	,04	1,80	F (4,13) = ,04
fears	-,22	-2,03				

Dependent Variable: Printing behavior, \* $p < 0,05$

**Hypothesis** *Teachers' lower ICT barriers and higher pro-environmental values orientation enhances higher pro-environmental printing behavior at elementary school.*

Table 16 presents the model summary for ICT barriers (fears), egoistic and biospheric values (independent variables) as well as the printing behavior (dependent variable). The results of the regression analysis reveal that teachers' biospheric values and fears are the significant factors at  $p < 0,001$  and  $p < 0,06$  that has effect on pro-environmental printing behavior at elementary schools. This shows teachers' higher biospheric values and lower ICT fears are better for pro-environmental printing behavior at elementary schools. Hence, the hypothesis is supported.

**Table 16: Regression between ICT barriers, values and printing behavior**

	$\beta$	t	$R^2$	Adjusted $R^2$	df	F
Printing Behavior			,20	,17	3,77	F (6,47) = ,001*
Egoistic	,13	1,21				
Biospheric	,35	3,37*				
fears	-,20	-1,85				

a. Dependent Variable: Printing behavior, \* $p < 0,05$

Considering the presented results and analysis of this study, a conclusion is drawn. Teachers' biospheric values have a positive influence on the pro-environmental printing and sufficient time, high ICT skills and lower fears towards ICT have positive influence on the pro-environmental printing behavior. This is in line with the previous studies, as according to McCool (2008) when ICT is used effectively, the use of paper can be reduced and thus decrease both financial and environmental costs. Furthermore, Lewis (2003) emphasized that without good resources teachers cannot be expected to overcome the ICT barriers.

## Discussion

***The higher teachers' pro-environmental values, the higher the reduction of environmental and financial costs at elementary schools measured in use of paper.***

The results of this study confirm that biospheric values are the significant element to influence pro-environmental printing behavior. Paper reduction is often a fairly simple way to reduce costs and increase company value (Citigroup, 2004). In addition, teachers' biospheric values orientation has a positive effect on teachers' pro-environmental printing behavior at elementary school. According to previous research, individuals with a biospheric value approach will primarily form their choice to act pro-environmentally or not, on the apparent costs and benefits for the environment and planet all together (De Groot & Steg, 2008). Hence, high pro-environmental

printing behavior means less printing at school which leads to less use of paper at elementary school; thus, saving financial and environmental costs.

***The lower teachers' barriers towards ICT, the lower the use of paper.***

The findings indicate teachers' fear of using ICT as being the reason to influence the pro-environmental printing behavior which is aligned with the previous literature review (Bingimlas, 2009; Colin and William, 2006; Pajo & Wallace, 2001; Andoh, 2012 and Lim and Khine, 2006). According to previous literature when ICT is used effectively, the use of paper can be reduced and thus decrease both financial and environmental costs (Citigroup, 2004). This means if teachers have less fears of using ICT, more knowledge of ICT and sufficient time to prepare their lessons then they are more inclined to have pro-environmental printing behavior. Pro-environmental printing behavior means less printing at elementary schools which is in line with previous literature review that reducing paper use and improving paper purchasing and handling is then a "win-win" scenario – it cuts costs and reduces environmental impacts (Citigroup, 2004; Dee, 2010; Thompson, 2009). Hence, this study confirms less fear leads to less printing; thus, less use of paper which is good for the environment, therefore, leading to less financial and environmental costs for the elementary schools.

***The lower ICT barriers and the higher pro-environmental values, the lower the environmental and financial costs at school measured in use of paper.***

The results confirm that less fears toward using ICT and higher biospheric values are enhancing pro-environmental printing behavior at elementary schools which is in line with the previous literature review (Bingimlas, 2009; Colin & William, 2006; Pajo & Wallace, 2001; Cuban, 2000; Andoh, 2012; Korte, & Husing, 2007; Ernest, 2006; Lim & Khine, 2006; Tsai, 2012; Cooper, 1998; Ertmer, 1999; Russell & Bradley, 1997; Kutami, 2009; Citigroup, 2004; McCool, 2008; Dee, 2010). Prior research reveals that ICT plays a vital role when it comes to reducing printing at work; for instance, by promoting digital documentation such as web-based applications, Google docs, Drop Box (Pajo & Wallace, 2001) and creating awareness in people to print double-sided, use USB sticks, and send documents through email instead of paper mail (Harack, 2010). Additionally, Steg and Vlek (2008) accredited that behavioral interventions are generally more effective when they are steadily planned, applied and evaluated. Hence, teachers' lower ICT barriers and higher biospheric values orientation have a positive impact on printing at elementary schools. Therefore, this study confirms that teachers' less printing at school will save financial and environmental costs at elementary schools.

**Conclusions**

The purpose of this study is to explore how to reduce environmental and financial costs through enhancing teachers' pro-environmental values and effective use of ICT at Dutch elementary schools. The outcomes of this study confirm that on the one hand, teachers with lower ICT fears have a positive effect on the pro-environmental printing behavior whilst on the other hand; teachers' biospheric values have a positive impact on the pro-environmental printing behavior at the elementary schools. This means if schools are able to minimize ICT barriers and promote biospheric values orientations among teachers, the schools can minimize their financial and environmental costs.

Additionally, this study also reveals that younger teachers have less fears and high ICT skills compared to older teachers. Furthermore, results indicate that younger teachers have higher egoistic and hedonic values orientation and lower prosocial and biospheric values orientation than older teachers. However, experienced teachers have higher biospheric values orientation and lower egoistic values orientation than less experienced teachers.

**Recommendation for Future research**

This study is carried out within seven elementary schools and is exclusively allocated for teachers' ICT barriers and pro-environmental values; however, students did not take part in this research. To find out the influence of teachers' pro-environmental values orientation on students, further information could be obtained from the students as well.

A similar study could be carried out in colleges and universities. The findings from colleges and universities might indicate whether they have comparable or completely different concerns in relation to ICT barriers and values orientations. Moreover, a comparative study could notify and enlighten any prospective to confront these ICT barriers. Besides, the outcomes might provide a contrast between the difficulties that elementary schools experience and the difficulties that colleges and universities experience.

The focus of this study is on pro-environmental values and pro-environmental printing behavior. It is recommended for future studies to find out the impact of egoistic values on the printing behavior and on the use of ICT.

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