New Perspectives in Science Education
International Conference
NEW PERSPECTIVES in SCIENCE EDUCATION

"WAKE UP"- Sensitization of Students for Stem Cell Donation for Leukaemia Patients

Julia Holzer[1], Doris Elster[2]

Abstract

The purpose of the study is to investigate the factors that influence students in decision making with regard to stem cell donation for leukaemia patients by using the theory of planned behavior (TPB) as a general conceptual framework. The changes in the theoretical determinants "attitudes", "subjective norm", or "perceptions of behavioral control" should effect changes in the "behavioral intention". All these determinants are based on corresponding beliefs, which informs us about cognitive foundation of the behavior in question. In line with this theoretical assumption, the main focus of this study is the development of an intervention, which is designed in a way to attack and change these particular beliefs that are ultimately guiding the performance of the intention for stem cell donation. In addition to the standard TPB-constructs an demographic categories (age, sex), factors of prosocial personality (moral obligation, emphatic concern, moral reasoning) as well as the factor self-identity-"helper" and content knowledge are assessed.

This study includes a sampling of 94 students, aged between 15 and 19 years. This group completed a pre- and post-questionnaire concerning the performance of registration as a stem cell donator for leukemia patients. The general findings and results demonstrate that the extended theory of planned behavior permits an accurate prediction of intention.

Keywords: *TPB-model, beliefs, intention, attitudes, norms and values, stem cell donation;*

1. Introduction

In Germany around 13.000-14.000 persons suffer from leukaemia each year [1]. Stem cell transplantation represents a curative treatment option for many leukaemia patients but requires a compatible and healthy stem cell donor. The number of stem cell donors among young people is low [2]. This study examines the influence of some selected factors on intention relating to the registration as a stem cell donor for leukaemia patients applying to the theory of planned behavior (TPB).

2. Conceptual framework

The TPB, which was developed mainly by Ajzen, forms the conceptual framework of this study [3]. TPB was proven by several meta-analyses and has proven its utility as a predictor of intentions and behavior across several domains. Briefly, the model posits intention (i.e., the motivation required to engage in behavior) as the proximal determinant of behavior. Intention is codetermined by general (positive or negative) evaluations of the behavior (attitude, ATT) and general perceptions of social pressure (subjective norm, SN). Furthermore, human's intention is influenced by self-efficacy in relation to the behavior (perceived behavioral control; PBC) (Fig. 1) [3].

These three major determinants in the TPB are traced to corresponding sets of behavior related beliefs. Consistent with expectancy-value theory, attitude toward registration as a stem cell donator for leukaemia patients is assumed to be determined by beliefs about the consequences of the performance of this behavior and, each belief is weighted by the subjective value of the outcome in question. A similar logic applies to the relation between normative beliefs and subjective norms and the relation between control beliefs and perceived behavioral control. As a general rule, the more favorable the attitude and subjective norm and the greater the perceived behavioral control, the stronger should be the person´s intention to perform the behavior in question [3].

[1] Institute of Science Education, Department of Biology Education, University of Bremen, Germany
[2] Institute of Science Education, Department of Biology Education, University of Bremen, Germany

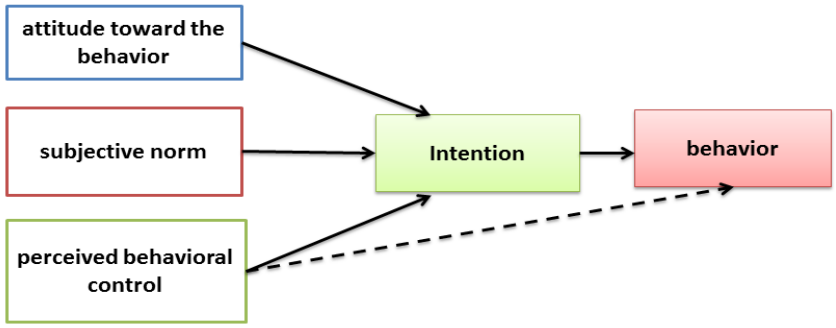

Figure 1: TPB-Model based on Ajzen [3]

3. Model of research

The TPB does not deny the importance of other factors that may place a burden on students. Therefore, in this study we decided to both examine the belief-based-constructs of TPB and intention and some model external factors, such as *content knowledge*, *self-identity as a helper*, and constructs of pro-social personality such as *moral obligation*, *moral reasoning* or *empathy* (Fig. 2). Intention is defined as a registration as a stem cell donator for leukaemia patients in the next time.

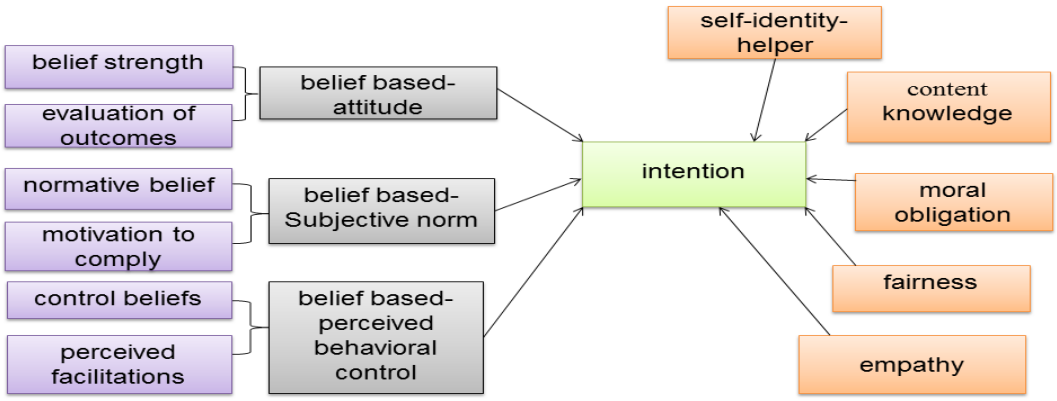

Figure 2: Research model based on the extended TPB-Model

4. Main objectives of the study

The goals of the evaluation of the intervention “WAKE-UP” are 1) To examine changes that occurred between pre- and post-test; and 2) to consider the predictive utility of the extended TPB-model: Could the intervention “Wake-Up” improve the predictive power of the extended TPB-model?

5. Method

5.1 Participants and design

A total of 94 students of the upper secondary level are the participants of this study (median age: 17,14). Out of these, 48 were women and 46 were men. For data collection a questionnaire pre and post the intervention is used. During the intervention students conduct hand-on and minds-on activities in the outreach lab and are engaged in discussion relevant to leukaemia and stem cell donation.

5.2 TPB Measures

The belief based determinants of intention (i.e., attitude, subjective norm, perceived behavioral control) as well as the intention itself are assessed using the factors presented in Table 1. Each construct is assessed on a 7-point unipolar scale ranging from 1 (i.e. unlikely) to 7 (i.e.very likely). The operationalization of the determinants is orientated on recommendations of Ajzen [3].

Table 1: TPB-Factors. Legend: Components of probability[1]: belief strength; normative & control beliefs and intention; Evaluations[2]: evaluation of outcomes, motivation to comply, perceived facilitations and intention

Factor (number of Items)	Items (Example)	pre KMO-Test	post KMO-Test	pre-α	post-α
belief based-(positive) attitudes (8)	**belief strength:** I could possibly save a life. **evaluation of outcomes:** To save a life by the stem cell donation I think is…	Com-ponents of proba-bility[1]: ,721 Eva-luations[2]: ,645	Com-ponents of proba-bility[1]: ,726 Eva-luations[2]: ,736	,850 ,698	,750 ,784
belief based-(negativ) attitudes (8)	**belief strength:** I could harm my health through a possible donation **evaluation of outcomes:** The belief that the stem cell donation harms the health, I think is…			,694 ,769	,647 ,817
belief based-subjective norms (10)	**normative belief:** Do your parents think that you should register as a stem cell donor? **motivation to comply:** How important is it for you to fulfill their expectations regarding your registration as a stem cell donor?			,873 ,917	,892 ,955
belief based-perceived-behavioral control (14)	**control beliefs:** I would have a very bad conscience for a very long time if I do not register as a stem cell donor. **perceived facilitations:** The bad conscience in case of non-registration as a stem cell donor is...			,724 ,713	,731 ,769
Intention (2)	How likely do you think you will register as a stem cell donor for leukemia patients in the foreseeable future?			,897	,922

5.3 Model external factors

Each model external factor (except *content knowledge*) is assessed on a 7-point unipolar scale (Table 2). The *content knowledge* was raised with open and closed questions. Closed questions indicate a dichotomous scale. The items of factors of prosocial personality (except: *moral obligation*) are extracted from Prosocial Personality Battery [4] .

Table 2: Model external factors

Factor (number of items)	Items (Example)	pre KMO-Test	post KMO-Test	pre-α	post-α
moral obligation (4)	I feel morally responsible to support the leukemia patients by registering as a potential stem cell donor	,770	,809	,863	,859
moral reasoning (5)	I choose a course of action that considers the rights of all people involved.			,745	,795
self-identity-helper (6)	I see myself as someone who likes to help other people			,795	,863
empathy (5)	I sometimes find it difficult to see things from the „other person´s" point of view.			,594	,567
content	Stem cells are ordinary body cells. Body				

knowledge1 (18) (dichotomous scale)	cells are cells that do not pass on their genetic material to the next generation.		KR-20 ,583	KR-20 ,498
content knowledge2 (5) (open questions)	What is a stem cell transplant?	Cohen´s Kappa (Mean): ,935		

6. Evaluation results and general discussion

According to Ajzen [3] belief-based-attitude is derived from the product of the perceived likelihood of outcomes (outcome beliefs) and the evaluation of those outcomes (evaluations). The same procedure was used to form multiplicative assumptions of belief-based subjective norm as well as for belief-based perceived behavioral control. Finally, we summed up the products of each construct and used the means for further statistical tests (i.e. T-tests or regression analyses).

6.1 Changes between pre- and post-test

Table 3 presents significant changes of factors of the TPB-model and in model external factors. Especially in belief-based-attitude the intervention is successful, because the positively change of negative behavioral beliefs with regard to the stem cell donation and leukaemia was the highest goal of this study. Furthermore the intention to register as a stem cell donator changes from a more negative (M=,3,68) to a more positive (M=4,47) intention. Also, the factor *content knowledge* shows a positive and significant (1: T=-7,107***; 2: T=-14,931***) change. If we look at modal external factors of pro-social personality, we can detect that only *moral obligation* (T=-3,203**) as well as *moral reasoning* (T=-2,331*) change significantly after intervention.

Table 3: Changes in TPB-factors and in model external factors (only factors with significant changes are reported).

factors		Mean	N	SD	T	Sig.(2-tailed)
belief based-(negativ) attitude	pre	78,22	92	36,916	-7,390	,000
	post	111,16		43,952		
belief based-perceived-behavioral control	pre	174,39	87	44,456	-4,311	,000
	post	192,21		54,526		
Intention	pre	3,68	93	1,554	-6,036	,000
	post	4,47		1,546		
content knowledge1	pre	14,78	80	2,338	-7,107	,000
	post	16,63		1,435		
content knowledge2	pre	3,78	94	2,035	-14,931	,000
	post	9,1		3,157		
self-identity-helper	pre	5,38	93	,930	-3,594	,001
	post	5,57		,955		
moral obligation	pre	4,56	93	1,336	-3,203	,002
	post	4,93		1,294		
moral reasoning	pre	4,89	93	,952	-2,331	,022
	post	5,07		,933		

6.2 Predictive utility of the extended TPB-model

Table 4 presents the results of hierarchical multiple regression analyses for the prediction of intentions to register as a stem cell donator for leukeamia patients before (pre-test) and after (post-test) the intervention “Wake-Up”. The belief-based measures of attitude, subjective norm and perceived behavioral control are entered on the first step by using “enter-method” and the model external factors on the second step by using “forward-method”.

The belief-based measure has a significant contribution to the prediction of intention, resulting in a multiple correlation of ,368 (R^2_{corr}= ,339) in pre-test, which decreases lightly in the post-test to ,279 (R^2_{corr}=,246). It means that around 37% (pre-test) and around 28% (post-test) of intention can be explained or can be predicted by belief-based-constructs of TPB-model. In pre- as well as in post-test the belief-based measure of PBC seems to be a great predictor of intention: this predictor demonstrates a significant beta- coefficient (pre: ,522; post: ,462). The addition of the model external factors *moral obligation* greatly improved the model´s predictive power: the R^2-coefficient increase from ,368 (R^2_{corr}=,339) to ,431 (R^2_{corr}=,398) in a pre-test and from ,279 (R^2_{corr}=,246) to ,433

(R^2_{corr}=,401) in post-test. Furthermore, the examination of the results in the second step shows that in the post-test the factor *content knowledge* was also included in the model. This factor even increases the predictive power of the model from ,433 (R^2_{corr}= ,401) to ,489 (R^2_{corr}=,453). To summarize briefly, the extended TPB-model, this includes both besides belief-based-constructs of intention and modal external factors such as *moral obligation* (pre and post) and *content knowledge* (post-test), gained 6% (changes in R^2=,063) in pre-test and 21% (changes in R^2= (,155+,055) of predictive power of intentions.

Table 4: Hierarchical Regression analyses: pre-post (N=94)

	pre-test						post-test					
Construct	R^2	R^2_{corr}	changes in R^2	F	β	T	R^2	R^2_{corr}	changes in R^2	F	β	T
Step 1 (enter-method)												
belief based-(positive) **ATT**					,012	0,132					-,014	-,140
belief based-(negative) **ATT**					,097	1,092					,119	1,206
belief based-**SN**					,093	1,004					,054	,585
belief based-**PBC**					,522	4,951***					,462	4,366***
	,368	,339	,368	12,946***			,279	,246	,279	8,597***		
Step 2 (forward-method)												
moral obligation	,431	,398	,063	13,304***	,315	,3112**	,433	,401	,155	13,460***	,473	4,901***
content knowledge2							,489	,453	,055	13,861***	,240	3,070**

7. Conclusions

To sum up, the positive and significant effects of the intervention "Wake-Up" are based on significant changes in belief based-TPB-factors as well as in modal external factors. The results of regression analyses demonstrate that three independent variables (attitude, subjective norm and perceived behavioral control) have a significant impact to the prediction of intentions. These factors explain around 37% (R^2=,368) of the assessed intentions in the pre-test and 28% (R^2=,279) in the post-test. Moreover, PBC was proved to have a significant effect on intention in pre- and also in post-test. The simultaneous integration of model external factors *moral obligation* and *content knowledge* improved the predictive power of the model: the extended model explained 49% of intention.

This study provides the evidence to support the utility of the extended TPB-model as a predictor of registration as a stem cell donator for leukaemia patients among young people.

References

[1] Zentrum für Krebsregisterdaten und der Gesellschaft der epidemiologischen Krebsregister in Deutschland E.V. "Krebs in Deutschland für 2013/2014" (11. Ausgabe), Robert Koch Institut - GEKID, Berlin, 2017, p. 128-131.

[2] Zentrales Knochenmarkspender-Register Deutschland. "Jahresbericht-Annual Report 2016/17". Ulm, ZKRD, 2017, p. 1-28.

[3] Ajzen, I. „Attitudes, Personality and Behavior" (2nd Ed.), New York, Open University Press, 2015.

[4] Penner, L. A. "The Causes of Sustained Volunteerism: An Interactionist Perspective."

[5] Journal of Social Issues, 58, 2002, p. 447-468.