

## ***A MOBILE APPROACH TO THE SPECIAL EDUCATION METHODS (PECS – PICTURE EXCHANGE COMMUNICATION SYSTEM)***

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*Abstract: Augmentative and Alternative Communication (AAC) is the term used to describe various methods of communication that can 'addon' to speech and aroused to get around problems with ordinary speech. AAC includes simple systems such as pictures, gestures and pointing, as well as more complex techniques involving powerful computer technology<sup>1</sup>. The picture exchange communication system (PECS)[1] is an augmentative communication system frequently used with children with autism but not limited to them. In the mobile era the interest towards the potential use of mobile technology to achieve educational objectives, in particular for children with Autistic Spectrum Disorder (ASD) and other types of disabilities[2] are in a continuous growth, because of the general trend of the society and on the other hand some of them are very interested and motivated to learn how to handle the mobile devices<sup>2</sup>.*

**Keywords:** *PECS, AAC, mobile communication book, autistic spectrum, disabilities.*

The Picture Exchange Communication System or PECS[1],[3],[4] approach is a modified applied behavior analysis program designed for early nonverbal symbolic communication training. It is not a program designed to teach speech, although the latter is encouraged indirectly and some children begin to spontaneously use speech while enrolled in the PECS program. The PECS training program was developed at the Delaware Autistic Program. PECS training occurs during typical activities within the natural settings of the classroom and the home. The communication training occurs within a broader positive behavioral support context entitled the Pyramid Approach<sup>3</sup>. Training techniques include strategies such as chaining, prompting/cuing, modeling, and environmental engineering<sup>4</sup>.

Although the PECS[4],[5] strategy is primarily used with individuals who are nonverbal, it could be used with individuals who are primarily echolalic, those who have unintelligible speech, and those who have only a small set of meaningful words or signs in their repertoire. Careful consideration of the program and its strengths and weaknesses should play an important role in program selection for each prospective communication learner.<sup>5</sup>

Phases of PECS[3],[4] method:

Phase I: Programming for PECS begins with three people in the training situation, the child (or adult) who will be transmitting a message, the person who receives the message

<sup>1</sup><http://www.communicationmatters.org.uk/page/what-is-aac>

<sup>2</sup>[http://www.academia.edu/3835753/Using\\_Mobile\\_Technology\\_in\\_Schools\\_to\\_Develop\\_Social\\_Skills\\_in\\_Children\\_with\\_Autism\\_Teacher\\_Attitude\\_Makes\\_All\\_the\\_Difference](http://www.academia.edu/3835753/Using_Mobile_Technology_in_Schools_to_Develop_Social_Skills_in_Children_with_Autism_Teacher_Attitude_Makes_All_the_Difference), Mintz, J. (2013). Using Mobile Technology in Schools to Develop Social Skills in Children with Autism: Teacher Attitude Makes All the Difference. In H. Yang, & S. Wang (Eds.), Cases on E-Learning Management: Development and Implementation (pp. 294-317).

<sup>3</sup>The Pyramid Approach to Education (2<sup>nd</sup> Edition). (Bondy & Sulzer-Azaroff, 2002. Pyramid Educational Products, Inc., Newark, DE)

<sup>4</sup>The Picture Exchange Communication System (PECS) Training Manual, 2<sup>nd</sup> Edition. (Frost & Bondy, 2002. Pyramid Educational Products, Inc., Newark, DE).

<sup>5</sup><http://www.iidc.indiana.edu/?pageId=525>

(e.g., Mom or the teacher), and the facilitative adult who deliberately assists the message sender to make the targeted response.

In Phase I, the program begins with enticement whereby the adult displays or shows a preferred object or food item to the child (or adult learner). As he or she reaches for the desired object, the facilitator assists the child to pick up a picture for the desired object or food item. He or she is physically assisted to give the picture to the message receiver who must be physically near the child (or adult ) communicator. The physical closeness allows the exchange to easily take place. The adult who receives the message (picture) does not say anything until the picture is offered. At that juncture, the message receiver says something such as “Oh, you want a pretzel (or whatever the picture represents) and gives the item to the person making the request. In Phase I, there is variation of the items requested, the person who receives the message, the facilitator, and the environment in which the exchange takes place. The objective is to have approximately 80 exchanges during the course of the day.

Phase II: the exchange continues with attempts to increase the independence of the student. The facilitator is still available for as-needed assistance. The student learns to remove the picture from a display board for the exchange. He or she must engage in more physical movement than in Phase I in order to accomplish the exchange. It is preferable to have the child or adult who is the PECS user be responsible for carrying his or her own communication book.

Phase III: the student learns to select the target picture from a choice of multiple pictures that differ in various dimensions. Error correction strategies are used when the response is incorrect.

Phase IV: the student combines the object picture with the carrier phrase “I want” on a sentence strip and gives the strip to the adult or communication partner.

Phase V: the student learns to respond to the question “What do you want?” by exchanging the sentence strip. Use of the questioning phrase is delayed until Phase V, because the exchange behavior should be automatic by that point in the programming sequence. Earlier use of the carrier phrase or an extended hand gesture is believed to provide undesirable cues relative to the desired behavior.

Phase VI: the student learns to respond to the questions “What do you want?” vs. “What do you see?” vs. “What do you have?” This last phase is designed to introduce the young communicator to commenting behavior; the previous stages focused on requesting behavior.

The classic materials are pictures used with the program may be photographs, colored or black and white line drawings, or even tangible symbols. Mayer-Johnson pictures symbols, often called PCS, although often used as stimulus material, are not a mandatory picture resource for the program. Selection of picture representation type and size is dependent on individual needs.



Fig.1. Sample of communication book<sup>6</sup>

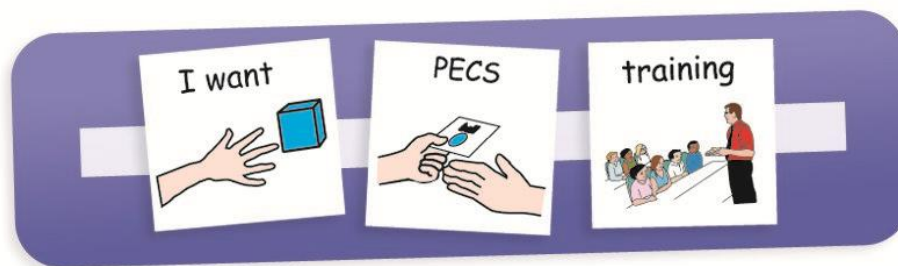


Fig.2. PECS board<sup>7</sup>

The digital version of PECS Phase III App<sup>8</sup> is motivating even more the disabled children and adults to use it. The structure and design of the book is identical and the features are far more numerous: the images and the caption can be easily changed, there dimension and the sound can be added for each pictogram.

<sup>6</sup><http://www.toypecs.com/>

<sup>7</sup><http://www.pecs-canada.com/archive.php>

<sup>8</sup><https://itunes.apple.com/us/app/pecs-phase-iii/id551356825?mt=8>



Fig.3. PECS Phase III App sample<sup>9</sup>

The studies made on individuals and groups working with the PECS system reveal many advantages<sup>10</sup>:

- since development in 1985, research indicates that PECS is a successful communication tool for learners of various ages and diagnoses;
- improvement in communication skills for the vast majority of participants When compared with other training methods those using PECS performed as well or better<sup>11</sup>;
- increases in functional communication skills;
- increases in spoken utterances, including increases in mean length of utterance (MLU);
- decreases in contextually inappropriate behaviors;
- research clearly suggests that PECS is an effective communication tool
- when difficulties arise, problems are often due to: lack of powerful reinforcers or trainer error.

A summary of relevant statistics about the mobile telephony and internet usage are as follows:

<sup>9</sup><https://itunes.apple.com/us/app/pecs-phase-iii/id551356825?mt=8>

<sup>10</sup><http://speechladies.pbworks.com/f/PECS.pdf>

<sup>11</sup>Sulzer-Azaroff B. et al. (2009) The Picture Exchange Communication System (PECS): What do the data say? Focus on Autism and Other Developmental Disabilities 24(2), pp. 89-103

The global mobile usage according to ITU Statistics (<http://www.itu.int/ict/statistics>):

Global ICT developments 2001-2014	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014*
Mobile-cellular telephone subscriptions	15,5	18,4	22,2	27,3	33,9	41,7	50,6	59,7	68,0	76,6	83,8	88,1	93,1	95,5
Individuals using the Internet	8,0	10,7	12,3	14,1	15,8	17,6	20,6	23,1	25,6	29,4	32,5	35,5	37,9	40,4
Fixed-telephone subscriptions	16,6	17,2	17,8	18,7	19,1	19,2	18,8	18,5	18,4	17,8	17,2	16,7	16,2	15,8
Active mobile-broadband subscriptions							4,0	6,3	9,0	11,5	16,7	21,7	26,7	32,0
Fixed (wired)-broadband subscriptions	0,6	1,0	1,6	2,4	3,4	4,3	5,2	6,1	6,9	7,6	8,4	9,0	9,4	9,8

Table 1. Global ICT development<sup>12</sup>

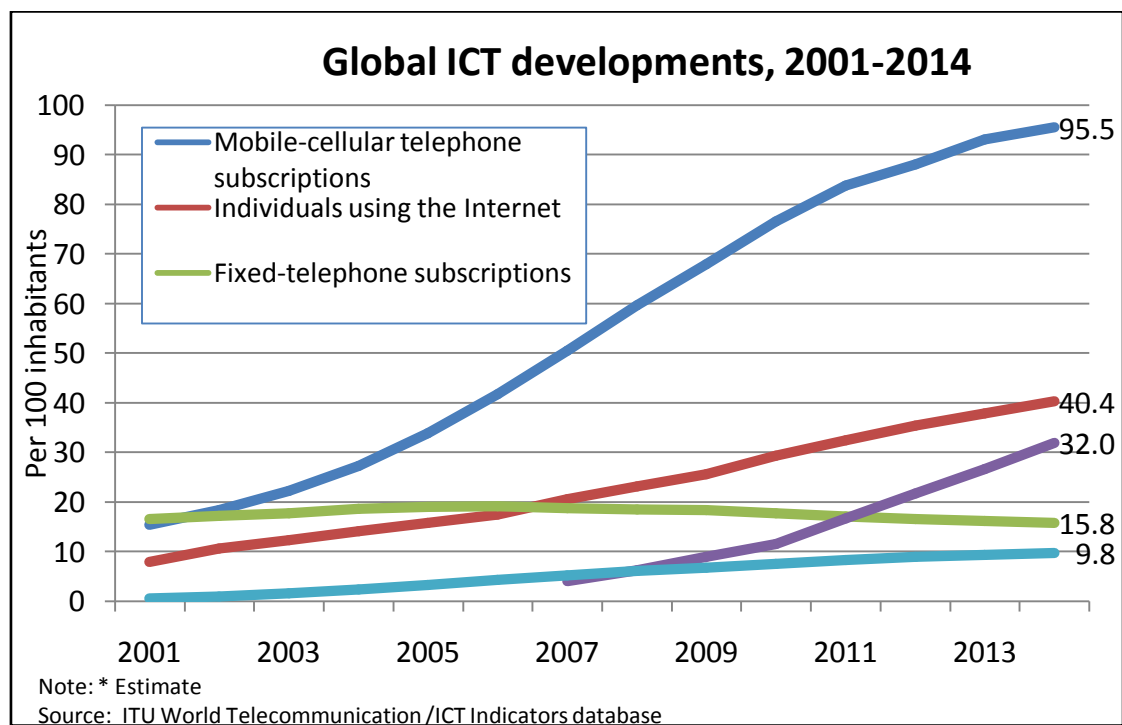


Fig.3. Global ICT development 2001-2014<sup>13</sup>

<sup>12</sup><http://www.itu.int/en/ITU-D/Statistics/Pages/stat/default.aspx>

<sup>13</sup><http://www.itu.int/en/ITU-D/Statistics/Pages/stat/default.aspx>

Year	Mobile-cellular telephone subscriptions	Mobile-cellular telephone subscriptions per 100 inhabitants
2000	2.499.000	11,16
2001	3.845.116	17,23
2002	5.110.591	22,97
2003	7.039.898	31,71
2004	10.215.388	46,10
2005	13.354.138	60,39
2006	15.991.000	72,47
2007	20.400.000	92,66
2008	24.470.000	111,40
2009	25.100.000	114,54
2010	24.360.000	111,43
2011	23.420.000	107,39
2012	22.840.000	104,99
2013	22.910.000	105,58

Table 2. Dynamics of mobile subscriptions in Romania between 2000-2013, according to National Authority for Management and Regulation in Communications of Romania and Romtelecom<sup>14</sup>

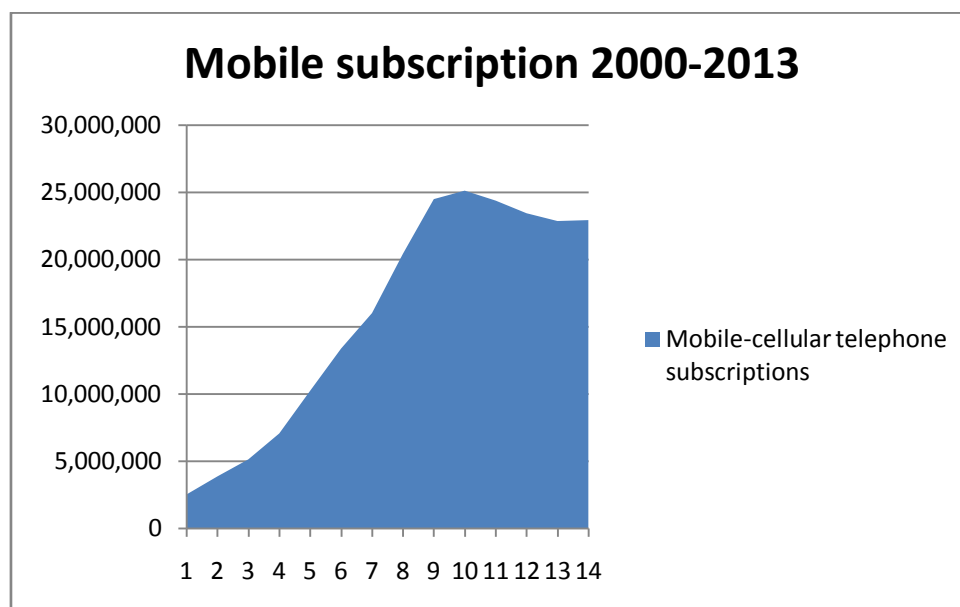


Fig.4. Dynamics of the mobile telephone subscription in Romania<sup>15</sup>

<sup>14</sup><http://www.itu.int/en/ITU-D/Statistics/Pages/stat/default.aspx>

<sup>15</sup><http://www.itu.int/en/ITU-D/Statistics/Pages/stat/default.aspx>

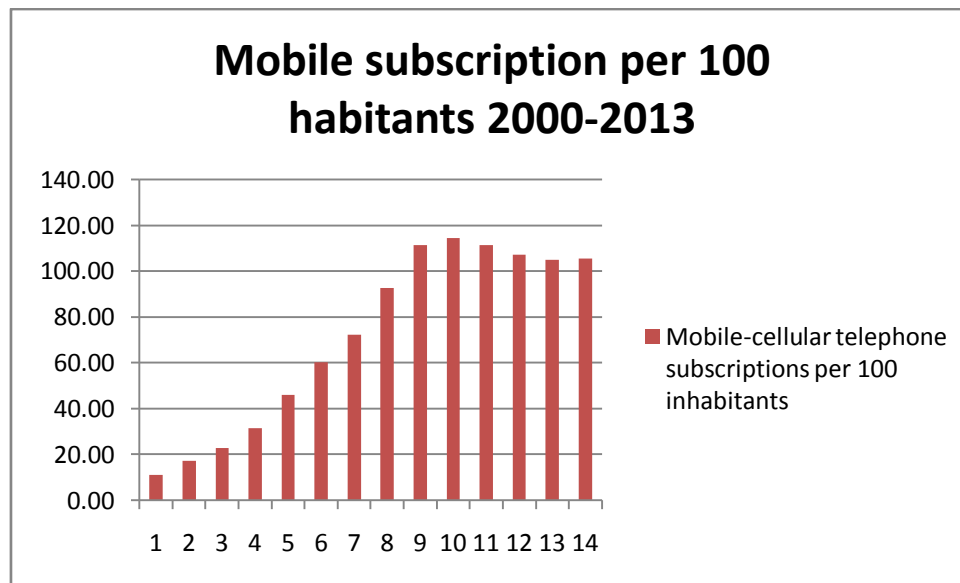


Fig.5. Dynamics of the mobile telephone subscription per 100 inhabitants in Romania<sup>16</sup>  
 A forecast model [6] for the usage of mobile subscription based on the trends above  
 Model Summary

Model Fit(a)

Fit Statistic	Mean	SE	Minimu m	Maximu m	Percentile		
					5	10	25
Stationary R-squared	-,001	.	-,001	-,001	-,001	-,001	-,001
<b>R-squared</b>	<b>,998</b>	.	<b>,998</b>	<b>,998</b>	<b>,998</b>	<b>,998</b>	<b>,998</b>
RMSE	1,409	.	1,409	1,409	1,409	1,409	1,409
MAPE	2,046	.	2,046	2,046	2,046	2,046	2,046
MaxAPE	4,763	.	4,763	4,763	4,763	4,763	4,763
MAE	1,064	.	1,064	1,064	1,064	1,064	1,064
MaxAE	2,900	.	2,900	2,900	2,900	2,900	2,900
Normalized BIC	,874	.	,874	,874	,874	,874	,874

Model Fit(b)

Fit Statistic	Percentile			
	50	75	90	95
Stationary R-squared	-,001	-,001	-,001	-,001
<b>R-squared</b>	<b>,998</b>	<b>,998</b>	<b>,998</b>	<b>,998</b>
RMSE	1,409	1,409	1,409	1,409
MAPE	2,046	2,046	2,046	2,046
MaxAPE	4,763	4,763	4,763	4,763
MAE	1,064	1,064	1,064	1,064
MaxAE	2,900	2,900	2,900	2,900

<sup>16</sup><http://www.itu.int/en/ITU-D/Statistics/Pages/stat/default.aspx>



Normalized BIC	,874	,874	,874	,874
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Table 3. Model fit (a), (b) for mobile subscriptions

Model Statistics

Model	Number of Predictors	Model Fit statistics	Ljung-Box Q(18)		
		Stationary R-squared	Statistics	DF	Sig.
Mobile cellular telephone subscriptions-Model_1	0	-,001	.	0	.

Table 4. Model statistics for mobile subscriptions

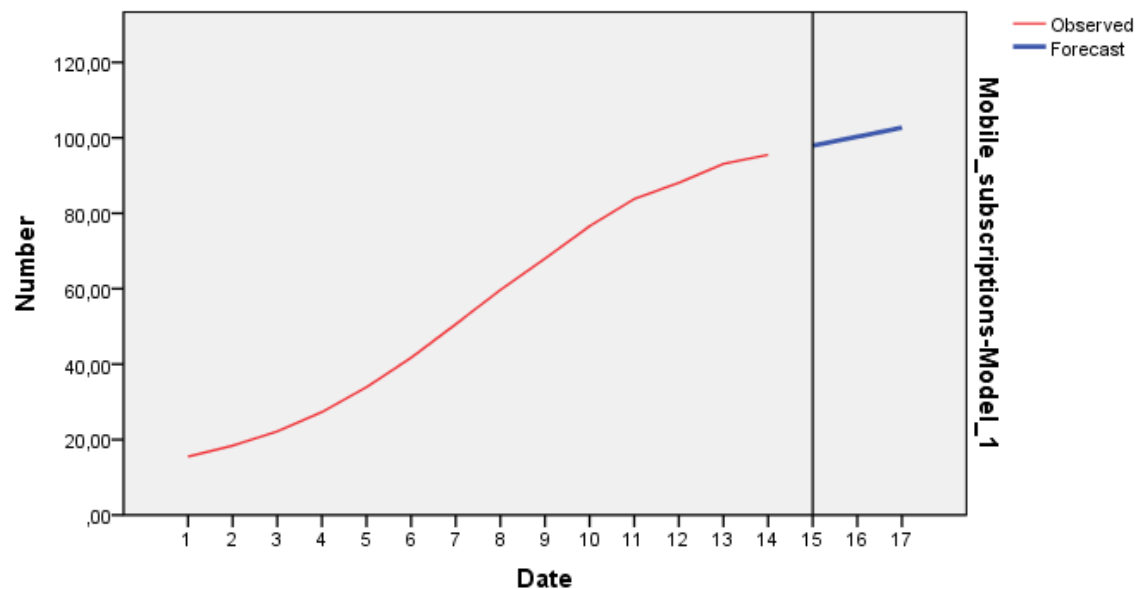


Fig.6.Forecast for mobile subscriptions for the next 2 years

## Model Summary

Model Fit(c)

Fit Statistic	Mean	SE	Minimum	Maximum	Percentile		
					5	10	25
Stationary R-squared	-,086	,203	-,229	,058	-,229	-,229	-,229
<b>R-squared</b>	<b>,993</b>	<b>,005</b>	<b>,989</b>	<b>,996</b>	<b>,989</b>	<b>,989</b>	<b>,989</b>
RMSE	,841	,280	,643	1,039	,643	,643	,643
MAPE	2,954	,858	2,348	3,561	2,348	2,348	2,348
MaxAPE	12,394	5,247	8,684	16,104	8,684	8,684	8,684
MAE	,465	,026	,447	,483	,447	,447	,447
MaxAE	1,993	,984	1,297	2,689	1,297	1,297	1,297
Normalized BIC	-,179	,728	-,694	,336	-,694	-,694	-,694



Model Fit(d)

Fit Statistic	Percentile			
	50	75	90	95
Stationary R-squared	-,086	,058	,058	,058
<b>R-squared</b>	<b>,993</b>	<b>,996</b>	<b>,996</b>	<b>,996</b>
RMSE	,841	1,039	1,039	1,039
MAPE	2,954	3,561	3,561	3,561
MaxAPE	12,394	16,104	16,104	16,104
MAE	,465	,483	,483	,483
MaxAE	1,993	2,689	2,689	2,689
Normalized BIC	-,179	,336	,336	,336

Table 5. Model fit (c), (d) for internet usage and mobile broadband subscriptions

Model Statistics

Model	Number of Predictors	Model Fit statistics	Ljung-Box Q(18)		
		Stationary R-squared	Statistics	DF	Sig.
Individuals using the Internet-Model_1	0	,058	.	0	.
Active mobile-broadband subscriptions-Model_2	0	-,229	.	0	.

Table 6. Model statistics for internet usage and mobile broadband subscriptions

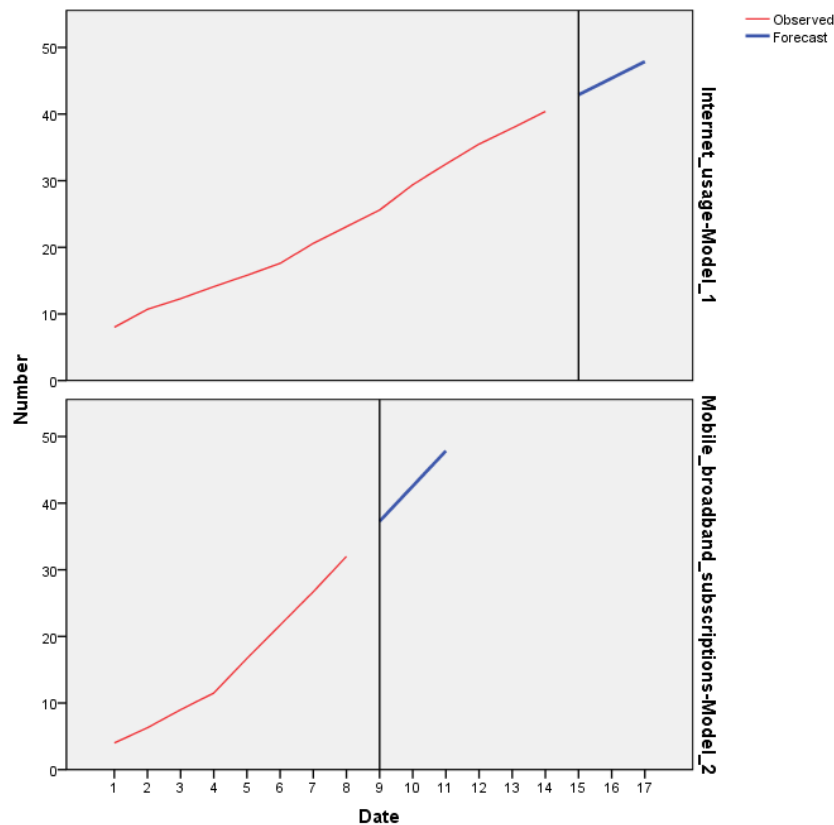


Fig.7.Forecast for internet usage and mobile broadband subscriptions for the next 2 years

In Fig.7 is depicted the individuals using internet and the equality of the statistical indicators<sup>17</sup>: correlation report (R) and correlation coefficient ( $r_{xy}$ ) with 0.99 prove the linearity of the model. We can conclude that the growth of the internet usage is in strong relation with the ox axis and in the following the trend will be ascendant.

From the data published by ITU the model can be formalized like in the table:

Years	x	y	x <sup>2</sup>	x*y	$y^{\wedge}=4.26+2.5*x$
0	1	2	3	4	5
2001	1	8.0	1.0	7.95	6.76
2002	2	10.7	4.0	21.40	9.26
2003	3	12.3	9.0	36.85	11.76
2004	4	14.1	16.0	56.38	14.26
2005	5	15.8	25.0	79.03	16.76
2006	6	17.6	36.0	105.33	19.26
2007	7	20.6	49.0	144.03	21.76
2008	8	23.1	64.0	185.03	24.26
2009	9	25.6	81.0	230.74	26.76
2010	10	29.4	100.0	294.13	29.26
2011	11	32.5	121.0	357.20	31.76
2012	12	35.5	144.0	425.69	34.26
2013	13	37.9	169.0	492.30	36.76

<sup>17</sup><http://www.biblioteca-digitala.ase.ro/biblioteca/carte2.asp?id=55&idb=>

2014	14	40.4	196	565.6	39.26
2015	15		225		41.76

Table 7. Estimation of the linear model of the internet usage

In the column 5 of the table 7 is calculated the estimative values of the internet usage based on the simple linear regression and the parameter estimation of the model:  $y=a + b*x$ ; Even if the number of PECS users are not exactly known we can conclude that the usage of electronic version of PECS will follow the general line of internet and mobile evolution showed by the ITU (International Telecommunication Union) is the United Nations specialized agency for information and communication technologies – ICTs and the ascending trends for the following years.

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