Identifying the Scale Components of Teacher Trainers' Professional Development in ICT

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***Abstract*—The national program of ICT in Israel emphasizes the professional development of teacher trainers in ICT and pedagogical innovation. The purpose of the study is to identify the scale components of teacher trainers' professional development in ICT. The research used quantitative method. 53 teacher trainers of a training program participated in the study. Subjects filled in a self-report questionnaire about their satisfaction from the training course and pedagogy and content knowledge self-efficacy. Exploratory and confirmatory factor analysis found the questionnaire in total valid and reliably explaining the characteristics of the training program and the contribution of five latent factors that are recommended to be components of teacher trainers' professional development in ICT scale: Applicative knowledge, learning process, teaching strategies, time management, and learning environment. The conclusion of the study is that a recommended model for professional development of teacher trainers in ICT will include these five components, while observing the development in a two-dimensional way: one – from simple to the complex, and two – from external to internal. Future research is recommended to continue and develop the professional development scale, and increase its validity through increasing the number of items collected from the literature, from joint discussions between teacher trainers and researchers, and from interviews with teacher trainers.**

***Index Terms*—ICT, professional development, teacher trainers.**

I. Introduction

In the era of the 21st century, computer and information skills are critical skills for day to day life in general and to academic development in particular [1], [2]. Preparing the education system graduates for the demands of the employment world of the 21st century is a need and a central national goal in the State of Israel [3]. The national ICT program has teacher trainers working to assist schools in promoting innovative pedagogy that integrates ICT, in accordance to the program's outputs. According to literature, assimilation of technology in schools is a long-term process, which only occurs if there is a change in the systemic characteristics [4].

Professional development of teachers and teacher trainers in ICT is an interesting subject due to the plan for adapting the education system for the 21st century and the challenges entailed. The unique role of teacher trainers is reflected in influencing the overview school level rather than at the individual teacher level. This is a complicated mission that requires a deep comprehensive organizational perspective. Therefore, the goal of the current pilot study is to identify and indicate the key components which are crucial for an effective model of teacher training courses.

A. The ICT Program in Israel

Since the 2010–2011 academic year, the Israeli Ministry of Education has run an innovative program to adapt the education system to the 21st century. The national program – "Adapting the Educational System to the 21st Century" is a program that aims to lead the implementation of innovative pedagogy in schools, while developing 21st century skills and integrating Information and Communication Technologies (ICT) in schools. Innovative pedagogy is a concept of teaching and learning, in which the content, the skills, and the learned knowledge are relevant for the dynamic reality nowadays and in future [2].

In addition to knowledge, the students gain relevant skills for optimum functioning in the 21st century (21st century skills); teaching is adapted to the diversity of students, it breaks down barriers between the school and the outside world, while making maximum, yet enlightened, use of technology to promote the teaching processes, both at the pedagogical level and at the pedagogical management level. Up to date, 1800 elementary and junior high schools (out of ~4000) take part in the program. Additionally, there are training courses for teachers and preservice teachers. The program includes a laptop for every teacher, projectors in the classrooms, and internet infrastructure and facilities.

Proper integration of information technology in teaching means implementing a holistic approach regarding some components that complement each other, as can be seen in Fig. 1.

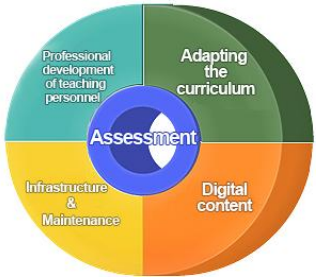

Fig. 1. The holistic approach of integrating ICT by the national program [3].

As shown in Fig. 1, the four elements presented on the exterior of the chart represent the program's main components: a) Professional development: Training courses for teachers and teacher-educators on various disciplines and inter-disciplines focusing on pedagogical aspects of ICT; b)

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Adapting the curriculum to be relevant to the 21st century demands; c) Infrastructure and maintenance equipping and operating supplement; d) Digital contents effective for digital literacy; and above all, continual evaluation and assessment of the processes.

The ICT program in Israel was shaped based on a systemic approach, that relies on a logical intervention model of inputs, outputs, and results, that forms a frame of planning, application and assessment. Close connection between inputs, outputs, and results, shows the logical basis of the rational of the intervention program [5]. The inputs of the ICT program include the resources given to schools, mainly guidance, equipment, and ongoing maintenance. The form of the guidance and its contents change according to the progression stages in the program [3]. Several groups of teacher trainers are being trained every year about the principles, the method and the skills needed for the teachers in schools.

B. Teacher Trainers (Teachers of Teachers)

Teacher trainers candidates are ICT literacy expert teachers with Master's degree and recommendations. Moreover, the attending teachers are characterized as leaders, practical and didactical knowledge owners, curious and motivational. Teacher trainers are expected to be role models to the teachers in schools.

Choosing the teacher trainer is done with pedagogical-technological considerations. A teacher who is chosen to teach teachers in ICT has professional-pedagogical authority to guide teachers' staffroom. The teacher is chosen due to his vast successful experience in the field, and his technological, pedagogical and content knowledge [3], called TPACK (Technological Pedagogy and Content Knowledge), a knowledge that characterizes the teachers ability to integrate technology into teaching in an informed way [6].

Teacher trainers are therefore crucial in supporting both new and experienced teachers, who need to acquire and develop knowledge, skills, and values in order to be effective in the classroom throughout their careers. Teacher trainers are thus key players in supporting teachers in raising student attainment [7].

Teacher trainers have direct influence over teachers to integrate technological innovations which are professional practices. It is clear to all that the technological innovation is dynamic and rapidly changing, therefore the teacher trainers need to be prepared through lifelong learning skills, constant learning, and adapting themselves to the progressing technological environment.

Professional development of teachers by teacher trainers consists of courses in strategies for promoting the ICT program's outputs and perceptions. In addition, the training process is consistently supported by learning communities, collaboration among experts, and updates of relevant trends around the world.

C. What do Teacher Trainers Need in the Field of ICT?

Developing a model for effective large-scale continuous professional development for teachers is a significant obstacle for many governments worldwide, because of various issues [8]. The main issues are related to the teachers' population perceptions and knowledge of digital learning concept, the teacher trainers' needs regarding their personal starting point and the schools they will work at, and the constant support and follow-up.

While most experienced teacher educators were mainly interested in improving their teaching skills, less experienced school-based teacher educators were more focused on aspects such as coaching skills [9]. In this case the focus should be on dealing with resistance to change and strategies for assimilations as well as didactical skills of content providing.

One of their training goals for trainee teachers is to develop the ICT skills required for professional effectiveness, planning and teaching [10]. However, their experience in their school-based teaching practice is very varied, and trainees find there are different levels of digital equipment available for the presentation and organization skills that will make them more effective in the classroom.

Albion, Tondeur, Forkosh-Baruch & Peeraer [11] suggested engaging teachers in school-based communities of practice and professional learning network, which have been shown to be effective for building ICT integration capability. This finding has been found relevant for teachers' positive changes in cognitive aspects of adapting innovative methods of teaching and learning [12].

Success of the program comes from its innovative bottom-up response and reconceptualization of course of professional development as being more than just externally designed courses. The program encourages and responds to teachers' reflective practice matching the teaching and learning demands of the twenty-first century [8].

D. The Course of Professional Development

The main goal of the course is to train teacher trainers who will guide the staff in schools which entered to ICT program. The aims are to shape attitudes and perceptions of 21st century literacy, to teach ideal innovative pedagogy through ICT, to make the program familiar, and to expose tools and possibilities of experiences [3].

Through the course, the teacher trainers learn, among other things, about the rationale of the ICT program, its fields of action and its principles. The course widens the learning and goes deep into the field of applying the outputs of the program, which are the actions required of the teachers to perform at school. At the preparation stage of the ICT program, the teacher trainer enters the staffroom and teaches all teachers about the program, particularly about its outputs. Therefore, each output is learnt during the course separately, with integrated reference to technological, pedagogical and content knowledge. The outputs in the programs are:

1) *Integrating ICT in the Teaching-Learning-Assessment Circle*: the teachers are required to teach ICT lessons, in which they integrate digital services, tools and learning materials. Also, the teachers are required to guide the students to perform ICT tasks at home. The frequency of the ICT lessons must be done gradually and adaptively. In order to apply this output in a quality way, the Ministry of Education makes accessible to teachers a portal of educational contents, which includes a pool of digital learning activities.
2) *Computer and Information Literacy*: Teachers are required to integrate computer and information skills in

the teaching-learning process according to a standardized program. This program is based on the suggestion of the international IEA organization (International Study of Computer and Information Literacy – ICILS) [13]. It includes file management, using a computer and peripheral equipment, word processor, presentation, electronic sheet, and internet – information and communication. It is a spiral program, based on age level.

3) *Online Pedagogical Management*: Teachers are required to use an online pedagogical management system throughout a school day. This technological system is meant to instill an organizational culture of exploration, drawing conclusions, and decision making through organizational and pedagogical information gathered during the learning. The usage of the online pedagogical management system includes: ongoing report of learners' achievements, disciplinary events, attendance, homework and summaries of the lessons given, periodical reports and students' certificates.
4) *School Portal*: Teachers are required to manage an online learning space in the school portal. The aim of the school portal is to reflect what is done at school in the organizational and pedagogical aspects. The relevant school information is updated consistently, for the public, the community, the parents, the student and the teaching staff.
5) *Collaborative Learning and Communication*: Teachers are required to apply collaborative learning activities and communication in the virtual space, while using a variety of collaborative tools, which allow participating in projects with other schools from different sectors, in different languages, and maintaining contact with experts. The teachers and students use the technology for communication with each other and communication between the students and parents.
6) *Internet Safety*: teachers are required to apply social learning activities to promote awareness of students to safety and ethical conduct online, while providing skills, values and norms for safe surfing on the net.
7) *Distant Learning in Routine and in Emergency Situations*: Teachers are required to be familiar with the possibilities of distant learning and applying it and the services given by the Ministry of Education. In emergency situations, when the regular learning activity at school is limited, teachers are required to conduct distant, structured, and guided learning and social activities as a substitution for classroom learning. In routine situations the teachers are required to conduct online communication and emergency situation activities drills with students [3].

As can be seen, the outputs of the program are characterized by complex pedagogical and organizational aspects and principle conduct alongside routine conduct, which shape the character of the school. Thus the learning about them requires deep understanding and the ability to teach. The emphasis in the learning is on understanding the relationship between the pedagogical knowledge, the didactical knowledge and the technological knowledge, that could help the teacher trainers to assess the practical meaning of the outputs. The professional development course is meant for this, and a study to assess the course is important for examining the effectiveness of the course, and for understanding the components of professional development at the teacher trainers level, in the context of assimilation of the national ICT program.

E. The Purpose of the Research

The purpose of the research is to identify the components of teacher trainers professional development in the field of ICT, in the context of assimilation of the national ICT program in schools.

II. Method

A. Participants

The study was conducted among 53 teacher trainers participating, which are about 20% of all teacher trainers who taught in the ICT program in the year of the study, 2014, who participated in professional development course in the field of ICT. Of whom 7 (13%) teachers, 10 (19%) school ICT coordinators, 23 (43%) ICT instructors and 13 (25%) lecturers.

B. Research Tool

For identifying the crucial components for holistic teachers training course and pedagogy and content knowledge self-efficacy a self-report feedback questionnaire was used. The items were focused on satisfaction of teacher trainers about participating in a professional development course in the field of ICT. The questionnaire was in Hebrew and was based on the Dayan and Magen-Nagar questionnaire [14], and it has 17 items. Filling the questionnaire was done by marking the most suitable answer on Likert scale of 4 stages, ranging from (1) Not at all, to (4) Very much. The internal reliability of the questionnaire was α=.85. In addition, the teacher trainers were requested to point out strengths and points for improvement in the course.

C. Procedure

In June 2014, as part of the national ICT program, a call for proposal was published, calling teaching workers that are interested in the position of teacher trainers. The conditions for acceptance were:

- A Master's degree recognized by the Ministry of Education, with preference to graduates of the program of Integration of Technology in Education.
- Proven experience in teacher guidance for at least two years – with preference to guidance in ICT program courses.
- Proven experience of at least two years in teaching in an ICT environment.
- Listed in the pool of lecturers of the Ministry of Education.

The candidates were invited to the course after submit the following documents to the supervisor of the professional development in ICT in the Ministry of Education headquarters: Resume, Certificate of a Master's degree, relevant approvals, and a recommendation from the supervisor of the ICT in the county.

A course was given during school holidays in three

condensed days, a total of 30 hours. At the end of the course, the teacher trainers filled out the current questionnaire online (on the Google Forms application). The time for filling out the questionnaire was about ten minutes. The data was processed in an exploratory and confirmatory factor analysis.

III. Results

A. Professional Development Components

In order to identify the components of professional development in ICT of teacher trainers, Principle components Exploratory Factor Analysis (EFA) was conducted, with Varimax rotation. Five factors that explained 64.92% of the variance were received. The results of the analysis are presented in Table I.

Table I shows that the factors in the questionnaire explain together in a considerable way the variance of the satisfaction from the professional development course in ICT. The items in the questionnaire grouped into five factors that express essential needs for teacher trainers in the field of ICT.

1) Factor no.1: Applicative Knowledge

Content knowledge practically applied in teaching in-action. Implementation of theories and concepts into eLearning teaching, through different levels and ages. Improvement of teaching skills.

TABLE I: Factor Analysis

No.	Item Content	L.F 1	L.F 2	L.F 3	L.F 4	L.F 5
Factor 1: Applicative Knowledge (6 items; Eigenvalue= 5.37; Explained Variance: 19.27%; α=.84;)						
11	I can implement what I have learnt in my work	.790	-.015	.124	.069	-.154
17	The adaptations for the different age levels were clarified and I can guide the teachers	.772	.266	.127	.151	.143
8	There was a link between the theoretical part and the practical part of the course	.753	.330	.005	.180	.179
14	The course met my expectations	.591	.553	.027	.194	.029
15	Following the course I can plan a learning session in the staffroom	.583	-.069	.487	.114	.165
7	The course contributed to the improvement of my teaching in an online environment	.499	.349	.440	-.082	.036
Factor 2: The Learning Process (4 items; Eigenvalue=1.97; Explained Variance: 15.74%; α=.68)						
13	The course contributed to the depth of my knowledge in the didactical area	.300	.796	.045	.046	.097
12	The peer learning during the course has helped me during the learning process	.024	.741	.131	.243	-.082
2	The course participants' experiences were expressed during the course	.135	.583	-.234	.191	.105
4	During the course I acquired new technological information	.098	.555	.335	-.294	.491
Factor 3: Teaching Methods (3 items; Eigenvalue=1.97; Explained Variance: 11.28%; α=.49)						
5	The lecturers were attentive to questions, comments and criticism of the participants	.086	-.035	.646	-.074	-.146
9	Teaching methods suitable for an online environment were used	-.065	.263	.609	.513	.166
16	The course's summative assignment provided me with knowledge/tools for my work	.273	.001	.587	.244	-.089
Factor 4: Time Management (2 items; Eigenvalue=1.24; Explained Variance: 9.72%; α=.59)						
1	The time of the course was used effectively	.190	.159	.042	.853	.066
6	The lecturers used the learning time effectively	.429	.253	.118	.534	-.031
Factor 5: Learning Environment (2 items; Eigenvalue=1.11; Explained Variance: 8.92%; α=.49)						
3	The Moodle environment accompanying the course was helpful for my learning	-.039	-.037	-.062	.104	.875
10	During the sessions I had experiences in front of the computer in the learnt contents	.355	.265	-.341	.010	.560

L.F= Loading Factor

An exception is item number 14 about expectations, which has an almost identical loading with factor no.2. On the other hand, perhaps these were the greatest teachers' expectations, as demonstrated by the qualitative verbal feedbacks:

"As a computer scientist and a lecturer -- I have learned so many techniques and strategies that will enable me to lead so many teachers to start a new era of education using the tools and methods of the 21st century"; "The great sessions absolutely have met my expectations".

This factor was found to be the most important contributor to professional development described by teacher trainees' attitudes, with a strong correlation of 0.79.

2) Factor no.2: Learning Process

Acquiring didactical and technical new knowledge throughout the training course due to peer-assisted learning and previous experiences.

The teachers mentioned the new knowledge and the collaborative learning within the group as great contributors to their training process, as expressed in their feedbacks:

"I have really appreciated the activism and the collaboration embracement. Actually this is the way to create professional communities of knowledge and practice in order to promote ICT"; "I gained new knowledge in terms of ICT tools and applications and clear concepts".

3) Factor no.3: Teaching Strategies

Teaching strategies suitable for ICT based learning environment, teaching through cooperation and continuous critique from trainees, in addition to practical final assignment.

"Verity of teaching strategies, hands-on, workshops, experiences"; "Highly effective eLearning using through Webex"

4) Factor no.4: Time Management

Effectiveness of teaching and learning time management. 7 out of 53 teachers thought the course was intensive yet effective; however 4 teachers argued there should have been

more time for actual practice and experience.

5) Factor no.5: Learning Environment

Moodle as LMS and computer time during training sessions. This factor should be considered as limited liability due to technical issues during the course, causing the Wi-Fi connection to disconnect, and also there was no Moodle available during the sessions. These issues were very frustrating for most of the teachers.

B. Confirmatory Factor Analysis

Following the results of the EFA, it was decided to test the validity of the questionnaire structure through Confirmatory Factor Analysis (CFA). This examination used Structural Equation Modeling (SEM) method with the statistical software AMOS (Analysis of Moment Structures) 22.0 [15]. AMOS model usually includes two parts: Measurement Model and Structural Model. In the current study, only the Measurement Model, which allows assessment of CFA, was tested. It classifies the factor combination of the latent variables in terms of the observed, measured variable. In this study, the following five latent variables were tested: applicative knowledge, learning process, time management, teaching strategies, and learning environment; each one had between 2–6 items, which were the measured variables. The model is based on calculating the correlation matrix between the measured variables, which expresses the convergent validity of the measured variables. If the correlations between the items that refer to the same latent factor will be higher that the correlations with items that refer to other factors in the model, then the measurement model has construct validity. This means the factor analysis was confirmed. Fig. 2 presents the confirmatory factor analysis.

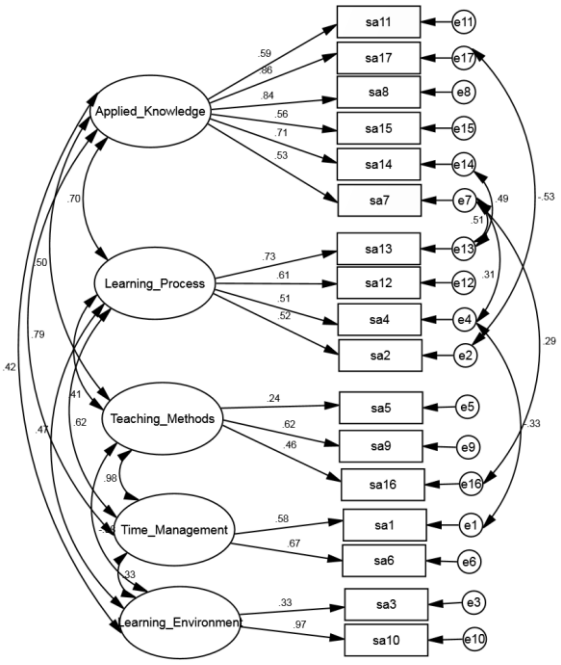

Fig. 2. CFA model of the scale "professional development of teacher trainers in ICT".

Fig. 2 presents the structural validity of the professional development of teacher trainers in ICT scale model through confirmatory factor analysis. First, the measurement model was assessed through the four indicators χ^2, RMSEA, NFI and CFI used to test the model best fit for reality [16]. As long as the value of χ^2 is low and insignificant, this means that the model fits reality [17], [18]. When the RMSEA value is 0.05 or less, it expresses a close fit; when the value is 0.08 or more, it reflects an error in structure, and when it is higher than 0.1 it requires rejecting the model. The closer the values of NFI and CFI to 1, the higher the fitness level [19], [17]. Table II presents the measurements indicators of the professional development of teacher trainers in ICT scale model.

TABLE II: THE MEASUREMENTS INDICATORS OF THE PROFESSIONAL DEVELOPMENT OF TEACHER TRAINERS IN ICT SCALE MODEL

Measurement indicators	Recommended level of measurement indicators	Indicator value
χ^2	n.s at $p < .05$	108.448, n.s.
χ^2 / df	< 5	1.05
CFI	>.90	.98
NFI	>.90	.72
RMSEA	<.05	.03

The results of the model presented in Table II show that the value of χ^2 (df=101) 108.45 is not statistically significant (p=.337). The indicator RMSEA (.032) is lower than .08. The indicator NFI (.978) is very high and is close to 1, and CFI (0.721) is lower than .09 and reflects low fit, however, the rest of the indicators reflect a good model that fits the study data.

1) Convergent validity — Estimation of the loading coefficients of the observed variables

Fig. 2 shows that most items of the five latent variables (applicative knowledge, learning process, teaching method, time management, and learning environment) are significant and reflect in a good way all the theoretical terms in the model, except item 3, "The Moodle environment accompanying the course was helpful for my learning" (λ=.33), and item 5 "The lecturers were attentive to questions, comments and criticism of the participants" (λ=.24). The loading level of these items reflect a lesser fit to the 'learning environment' variable and the 'teaching method' variable, although it can be seen as satisfactory, when the analysis model is received as stable and fits reality. As said, these indicators were low for different reasons, but their theoretical and research contribution cannot be disregarded, despite their low loading level.

It appears that the standardized loading coefficients of the items of the 'applicative knowledge' variable range between .53 – .86; the item that turned out to be the most valid is item 17 "The adaptations for the different age levels were clarified and I can guide the teachers". The standardized loading coefficients of the items of the 'learning process' variable range between .51–.73; the item that turned out to be the most valid is item 13 "The course contributed to the depth of my knowledge in the didactical area". The standardized loading coefficients of the items of the 'teaching strategies' variable range between .24–.62; the item that turned out to be the most valid is item 9 "Teaching strategies suitable for an online environment were used". The standardized loading coefficients of the items of the 'time management' variable range between .67–.58; the item that turned out to be the most valid is item 6 "The lecturers used the learning time effectively". The standardized loading coefficients of the items of the 'learning environment' variable range

between .33–.97; the item that turned out to be the most valid is item 10 "During the sessions I had experiences in front of the computer in the learnt contents".

The results of the goodness of fit model and estimation of loading coefficients of the observed variables show that all terms were measured validly; therefore they reinforce the theoretical bases that guided the choice of the different variables to measure the scale of professional development of teacher trainers in ICT.

IV. Discussion and Conclusions

The current study aims to identify a scale of components of professional development of teacher trainers in ICT. The model suggested in this study explains in total the scale of components, with a total explained variance of 64.92% and value of 0.98 CFI in the CFA.

The national ICT program in Israel has two main goals: a. implementing innovative pedagogy; b. providing 21st century skills for students. The pedagogical principles of the program are: 1). Informed application of digital teaching and learning that integrates technology in the classroom; 2). Promoting teaching-learning that applies constructing individual and collaborative knowledge and independent learning based on research and integration of innovative technological tools; 3). Creating and making accessible suitable digital learning materials and effective use of those; 4). Managing teaching-learning in an online organizational tool; 5). Basing the learning on the classroom-home constant, while expanding the classroom boundaries and effective learning times; 6). Providing for the diversity between learners and variety of learning styles [3]. These goals are translated into outputs that are presented in the literature review. These outputs are complex and require significant guidance from national and county bodies. The teacher trainers are to achieve the goals at the school level, which means they have to bring systemic pedagogical change, while providing output focused guidance. Therefore, they must provide a wide and varied guidance.

One of the meaningful components is *applicative knowledge*, it is a combination of pedagogical knowledge, didactical knowledge and technological knowledge, which focuses mainly on the ability to make suitable in an informed way, the technological tools and services for the learning subjects according to the age levels and the diversity between students. This means, the teacher trainers should recognize the needs of teachers according to the age group that they teach and the learning styles in the class. Teachers who teach in classes of young ages need different instructions than teachers who teach in classes of more mature ages. The diversity between classes calls for adapted teaching. This component was found in the factor analysis to be highly effective (explained variance of 19.27%) on the scale of professional development of teacher trainers in ICT. It is likely that this characteristic is related to a more progressive and mature stage of the teacher trainer's knowledge that is necessary to professional development, than the other components.

The next component, which explained 15.74% of the total variance, was the *learning process*. The learning process included deepening the didactical knowledge of how to teach the subjects of ICT, peer learning between the teacher trainers, practical experience, and acquiring technological knowledge. This component was found critical also in the research of [9] and [10]. Every teacher must be committed to lifelong learning, and the environment must provide them with the knowledge and tools fit for functioning in the changing reality [20]. Therefore, teacher trainers hold a key role in the learning process of teachers, they have the professional authority over teachers, and they influence the teacher's work in an ICT environment. Thus it appears that they feel obliged to learn themselves, and go through a process of internal, intra-personal change, to learn the advanced technology and the innovative approaches to learning, and to experience the development and planning of contents in an ICT environment.

Teaching strategies were also found in the factor analysis and the verbal feedback of the participants to be one of the more meaningful components for the teachers regarding their training process. It appears that teaching strategies is a component that combines pedagogical knowledge, didactical knowledge and technological knowledge. The lecturers' attitude, their role model including using teaching methods that appropriate ICT environment, as well as the summative assignment- These are the methods that the teachers evaluated and they support the findings of [9] and [12]. It is possible that learning the outputs of the ICT program is done in teaching strategies adapted to the unique structure of each output. These teaching strategies are a role model in guiding teachers for the teacher trainers. It is also likely that the teacher trainers understand, in an internal-reflective way, the importance of learning teaching strategies in an ICT environment which changes consistently. Therefore, they need to learn to deal with the technological changes and know how to implement them in teachers' guidance.

Time Management. Using time efficiently. Although this component was not reviewed in the literature as one of the main components in the scale of professional development of teacher trainers in ICT, it rose from the field, and also was reported in the verbal feedbacks, as a relevant factor that the participants regard. Also, in the CFA this latent factor was found to be highly correlated, 0.79, with the most significant factor – applicative knowledge, and hence we can presume its high importance. Perhaps time management is more about the organizational aspect of the course, and not directly about pedagogy and organization of ICT; on the surface, it seems that it fits any field of professional development. However, effective time management in ICT learning may indicate a quality and successful lesson organization.

Learning Environment. Moodle, experience in front of a computer. [8] mentioned learning environments as one of the key components as well as one of the challenges in professional development in ICT. The updated innovative pedagogy is based on complex learning behavior, that require learning in a social and collaborative context, while using the potential of the technology in the studied field [21]. Therefore, an ICT learning environment is a necessary condition to applying this kind of learning. Therefore, it seems that the teacher trainers recognize the importance of a rich, interactive learning environment, such as Moodle, and also direct experience with the computer. It is likely that the more the teacher trainers are familiar with the ICT learning environments, the simpler it would be for them to provide

guidance. However, sometimes the technological infrastructure is a strong obstacle that overpowers the quality of learning, i. e. professional development. Therefore, when innovative change is being considered, there must be commitment of external bodies to provide handy and accessible technological infrastructure, adapted to the professional development of the teacher trainers.

In summary, within the progression towards adapting the education system to the 21st century, in the professional development of teacher trainers, it is recommended to train the teacher trainers according to a developmental model which includes a scale of five components, which are built upon each other in different strengths: applicative knowledge, learning process, teaching strategies, time management, and learning environment. This is a two dimensional model, which expresses the interaction of two holistic approaches: 1. Dynamic development of simple and easy to understand processes in the context of achieving the goals of the ICT program, applying its outputs, to complexed processes that require the integration of technological, pedagogical, and content knowledge and school conditions; 2. Dynamic development of external and environmental processes to internal and intrapersonal processes of the teacher trainer in the context of personal and professional development in ICT. Fig. 3 describes the model.

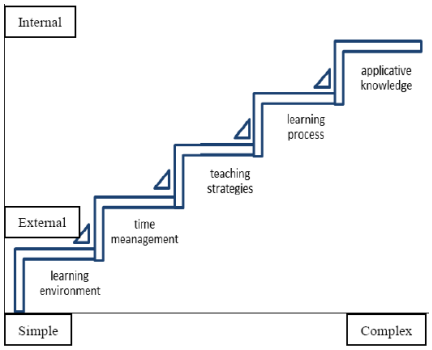

Fig. 3. A model of professional development of teacher trainers in ICT.

The current study is a pilot study in the field, therefore it is recommended to continue and develop the scale of professional development and strengthen its validity, by increasing the number of items taken from the literature, from joint discussions between the teacher trainers and researchers and from interviews with the teacher

REFERENCES

[1] T. S. Chee, S. Divaharan, L. Tan, and C. H. Mun, "Self directed learning with ICT," *Theory, Practice and Assessment*, pp. 1–65, 2011.
[2] M. Fullan, and M. Langworthy, *Towards a New End: New Pedagogies for Deep Learning*, Washington: Collaborative Impact, 2013.
[3] Ministry of Education, Israel. (August 2015). The national program — Adapting the education system to the 21st century — vision and rationale. [Online]. Available: http://cms.education.gov.il/EducationCMS/Units/MadaTech/ICTInEducation/Odot/
[4] P. A. Ertmer and A. T. Ottenbreit-Leftwich, "Teacher technology change: How knowledge, confidence, beliefs, and culture intersect," *Journal of Research on Technology in Education*, vol. 42, no. 3, pp. 255-284, 2010.
[5] D. L. Sundra, J. Scherer, and L. A. Anderson, "A guide to logic model development for CDC's prevention research center," *Atlanta, GA: Prevention Research Centers Program Office, Centers for Disease Control*, 2003.
[6] M. Koehler and P. Mishra, "Introducing TPCK. In AACTE committee on innovation and technology," *Handbook of Technological Pedagogical Content Knowledge (TPCK)*, New York: Routledge, 2008.
[7] European Commission. (January 2013). Supporting teacher educators for better learning outcomes. [Online]. Available: http://ec.europa.eu/education/policy/school/doc/support-teacher-educators_en.pdf
[8] P. Bradshaw, P. Twining, and C. S. Walsh, "The vital program: Transforming ICT professional development," *American Journal of Distance Education*, vol. 26, no. 2, pp. 74-85, May 2012.
[9] J. Dengerink, M. Lunenberg, and Q. Kools, "What and how teacher educators prefer to learn," *Journal of Education for Teaching*, vol. 41, no. 1, pp. 78–96, February 2015.
[10] G. Newton, A. Thethi, and A. Boddison, "Exploring trainee teachers'ict skills and their impact upon future PGCE course development," *Edulearn14 Proceedings*, pp. 3786-3791, 2014.
[11] P. R. Albion, J. Tondeur, A. Forkosh-Baruch, and J. Peeraer, "Teachers' professional development for ICT integration: Towards a reciprocal relationship between research and practice," *Education and Information Technologies*, vol. 20, no. 4, pp. 655-673, May 2015.
[12] S. K. Wang, H. Y. Hsu, T. C. Reeves, and D. C Coster, "Professional development to enhance teachers' practices in using information and communication technologies (ICTs) as cognitive tools: Lessons learned from a design-based research study," *Computers & Education*, vol. 79, pp. 101-115, October 2014.
[13] J. Fraillon and J. Ainley. (January 2015). The IEA international study of computer and information literacy (ICILS). [Online]. Available: http://forms.acer.edu.au/icils/documents/ICILS-Detailed-Project-Description
[14] R. Dayan, and N. Magen-Nagar, "Teachers satisfaction following online courses in the ICT field," *MEITAL's 11th National Convention Book: The World of Open Information — New Technologies and the Ways to Evaluate Them in Online Teaching and Learning*, Jerusalem: The Hebrew University, pp. 136-140, 2013.
[15] J. L. Arbuckle, *AMOS 22.0 User's Guide*, Chicago: SPSS Inc., 2013.
[16] P. M. Bentler and D. G. Bonett, "Significance tests and goodness of fit in the analysis of covariance structures," *Psychological Bulletin*, vol. 88, no. 3, pp. 588–606, November 1980.
[17] R. H. Hoyle and A. T. Panter, "Writing about structural equation models," *Structural Equation Modeling: Concepts, Issues, and Applications*, Newbury Park Ca: Sage, pp. 158-176, 1995.
[18] R. B. Kline, *Principles and Practice of Structural Equation Modeling*, New York: Guilford Press, 2016.
[19] B. M. Byrne, *Structural Equation Modeling with AMOS*, Mahwah, NJ: Lawrence Erlbaum Associates, 2010.
[20] D. Aspin, J. Chapman, K. Evans, and R. Bagnall, *Second International Handbook of Lifelong Learning*, Dordrecht: Springer, 2012.
[21] C. J. Bonk, "For openers: How technology is changing school," *Educational Leadership*, vol. 67, no. 7, pp. 60-65, 2010.

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