

# Translation of Texts from Croatian into English

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**Benčić, Elly**

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UNIVERSITY OF RIJEKA

FACULTY OF HUMANITIES AND SOCIAL SCIENCES

DEPARTMENT OF ENGLISH

Elly Benčić

**TRANSLATION OF TEXTS**  
**FROM CROATIAN INTO ENGLISH**

Submitted in partial fulfilment

of the requirements for the B.A. in English Language and Literature

and Pedagogy at the University of Rijeka

**Supervisor: Nikola Tutek dr.sc.**

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## **ABSTRACT**

This B.A. thesis is focused on the field of translation, i.e. translating texts from Croatian into English. The aim of this thesis was to choose three relevant, scientific and academic articles in Croatian, and to translate and analyze them into English. The introduction is followed by three source texts, each with a commentary and analysis, a description of translation methods and the most significant problems and, with that, solutions that occurred during the translation process. After the third translation analysis, there is a conclusion, where the entire thesis is summed up and critically overviewed. At the end of the thesis a list of sources is provided.

Keywords: translation, analysis, commentary, problems, solutions

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## Introduction

In this thesis, I will translate three relevant and scientific text excerpts from Croatian into English. The first text is from the field of pedagogy and is an excerpt taken from a book entitled *Obrazovanje i razvoj: kako obrazovanje razvija ljude i mijenja društvo, a kako društvo djeluje na obrazovanje* by Nikola Pastuović. The book is seen as a scientific contribution to the interdisciplinary science of education systems, as the author focuses on the aims of education and the means to successfully fulfill them.

The second text is from the field of polytechnics and design and is entitled *Novi oblik e-poslovanja kroz 3D print tehnologiju* by Olivia-Silvana Prlić and Andriana Lacković. It is focused on the modern and emerging 3D print technology and its advantages and disadvantages in the world of advanced technology.

The third text is an excerpt from a professional paper entitled *Obrazovanje učitelja i suvremena obrazovna tehnologija u području odgoja i obrazovanja i obrazovanja za okoliš/održivi razvoj* by Dunja Anđić. The author is focused on the challenges of new global conceptions that determine education, which leads to changing the traditional teacher roles, their methods and technologies.

Each translation from Croatian to English is followed by a commentary and analysis, i.e. workflow. The art of translation is a complex and demanding process, which requires accuracy and several alterations, whilst still making the translation as similar as possible to the source text. The translator is required to alter and perfect his translations as many times as needed. Problems arise when the translator must consider the syntactic, semantic and lexical differences of the source and target language. It is also important to pay attention to the language uniqueness and specific technology.

## 2. SOURCE TEXT 1

Nikola Pastuović

### **OBRAZOVANJE I RAZVOJ**

Kako obrazovanje razvija ljude i mijenja društvo,  
a kako društvo djeluje na obrazovanje

Institut za društvena istraživanja u Zagrebu

Učiteljski fakultet Sveučilišta u Zagrebu

Zagreb, 2012.

## UVOD

U uvjetima globalizacije i međunarodne utakmice problematika gospodarskog i društvenog razvoja postaje sve važnijim predmetom rasprava u međunarodnim organizacijama koje se bave razvojem, predmetom nacionalnih razvojnih politika te znanstvenih istraživanja razvoja. U tom kontekstu razmatra se razvojna uloga obrazovanja, odnosno njegov mogući doprinos pojedinim dimenzijama društvenog razvoja. Drži se neupitnim da je razvojni potencijal obrazovanja velik, gotovo presudan, te da razvojem znanosti i novih tehnologija raste do te mjere da se drži jednom od glavnih poluga napretka. Takvo gledanje najbolje dolazi do izražaja u konceptima “društva znanja” i “gospodarstva utemeljenog na znanju” u kojima se znanje, odnosno obrazovanje, smatra glavnim razvojnim resursom. Pri tome se osobito naglašava uloga obrazovanja u gospodarskom rastu i razvoju, a manje se analiziraju njegovi doprinosi drugim dimenzijama društvenog razvoja. Kako razvojni potencijal obrazovanja ovisi o dosegnutoj razini gospodarstva, političkom ustroju i sociokulturnom kapitalu, istraživanja uloge obrazovanja u razvoju i strateško planiranje obrazovanja trebalo bi voditi računa o cjelini društvenog konteksta. O njemu, naime, ne ovise samo društvene potrebe za obrazovanjem, nego i njegove mogućnosti da ih zadovolji.

Razvojna očekivanja u odnosu na obrazovanje oscilirala su tijekom posljednjih desetljeća. Aspiracije što su šezdesetih godina bile potaknute otkrićima američkih ekonomista obrazovanja o doprinosu obrazovnih investicija gospodarskom rastu SAD-a, nisu se ostvarile u zemljama koje su svoje gospodarsko zaostajanje mislile riješiti izdašnim ulaganjima u edukaciju svojega stanovništva. Izlazi iz obrazovanja nisu se na najbolji način koristili u pojedinim podsustavima njegove okoline. Najbolje obrazovani ljudi napuštali su takve sredine i odlazili iz zemalja u kojima su stekli kvalitetno visoko obrazovanje i time više pridonosili razvoju razvijenih nego nerazvijenih zemalja. Očito, obrazovanje je tako snažno kontekstualizirano da njegovi učinci ovise o sinergijskom djelovanju ostalih dijelova društva pa obrazovne reforme bez društvenih ne ispunjavaju očekivanja.

Drugi razlog zbog kojih je šezdesetih godina došlo do svojevrsnog razočaranja u obrazovanje jest sve brže zastarijevanje znanja stečenog školovanjem. Poluživot nekih znanja u profesijama temeljenima na znanosti skratio se na ispod pet godina tako da je gospodarstvo bilo sve manje zadovoljno kvalitetom obrazovanih ljudi koje je zapošljavalo. Sve se je otvorenije počelo govoriti o “krizi obrazovanja” koja, zbog svoje globalne rasprostranjenosti, poprima značajke “svjetske krize obrazovanja”. To je u radnim tijelima UNESCO-a potaknulo debatu o samim temeljima obrazovanja te dovelo do redefinicije njegova koncepta. Glavna konceptualna

inovacija sastojala se u formuliranju ideje cjeloživotnog učenja kao odgovora na ubrzane globalne tehnološke, gospodarske, ali i političke i kulturološke promjene. Promovirana je ideja da učiti treba cijeli život makar se ne može cijeli život ići u školu. Zato se cjeloživotno učenje, osim školovanjem, ostvaruje s pomoću neformalnog obrazovanja i informalnog učenja. To je pak dovelo do rekonceptualizacije i samog školovanja koje se usredotočuje na posredovanje znanja dugog poluživota, dok se specifična znanja manje transferne vrijednosti posreduju drugim oblicima cjeloživotnog učenja. Kao logična posljedica toga afirmiralo se područje obrazovanja odraslih, jer je doba odraslosti najduže životno razdoblje tijekom kojega se ostvaruje cjeloživotno učenje. Iz svega rečenoga proizlazi da istraživanja uloge obrazovanja u razvoju moraju uzeti u obzir i promijenjeno shvaćanje samoga obrazovanja.

Mogli bismo zaključiti da su istraživanja razvojne uloge obrazovanja išla u dva smjera; prema istraživanju međudjelovanja obrazovanja i društva te prema istraživanju optimalnog koncepta i strukture obrazovnih sustava i transformacijskih procesa u obrazovnim organizacijama kojima se osiguravaju poželjni izlazi i ishodi iz obrazovnog sustava. To je pak dovelo do fokusiranja istraživačke pozornosti na učenika, odnosno na osobu koja uči, jer o primjerenosti edukacije osobinama učeće osobe ovisi njezin uspjeh. Rezultati psihologijskih istraživanja razvoja osobe postali su važnima za procjenu i ostvarenje edukacijskih mogućnosti u formiranju onih svojstava ličnosti što su ključna za ostvarivanja društvenih ciljeva obrazovanja, a ujedno doprinose i razvoju same osobe. Kako je čovjek glavni akter razvoja, poznavanje strukture ljudske ličnosti i poznavanje zakonitosti njezina razvoja postaje relevantnim za određivanje i za ostvarivanje ostalih ciljeva društvenog razvoja. To je do sada bilo najviše zanemareno područje u istraživanjima razvoja.

Da bi se mogla procijeniti realističnost obrazovnih razvojnih očekivanja, potrebno je ponajprije jednoznačno definirati sam koncept razvoja te njegove ciljeve i svrhu. Kako je razvojni fenomen višedimenzionalan, potrebno je operativno definirati njegove glavne dimenzije: gospodarstvo, politiku i sociokulturni kapital. Budući da su pojedini razvoji u međudjelovanju, potpomažu se ili ograničavaju, nužno je otkriti njihove moguće interakcije. Obrazovanje se smatra važnim razvojnim čimbenikom svih razvojnih dimenzija pa njegovo djelovanje treba promotriti u kontekstu njihovih međudjelovanja.

Posebnu je pozornost potrebno posvetiti međuodnosu kvalitete ljudskih resursa, odnosno kvalitete ljudskog kapitala i pojedinih dimenzija društvenog razvoja jer se obrazovanjem na društveni razvoj može djelovati samo preko unapređivanja kvalitete ljudskog kapitala. No, ljudski kapital ne proizvodi razvoj bezuvjetno pa se s tim u vezi postavlja pitanje



koji su olakšavajući, odnosno ograničavajući čimbenici o kojima ovisi društvena “isplativost” obrazovanja. Nejednaka djelotvornost obrazovanja u različitim društvenim okolnostima, ali i unutar istog sustava, dijelom se može objasniti s pomoću razlika u sociokulturnom kapitalu što postaje važnim konceptom u teoriji razvoja. No, iznad tih pitanja ključno je pitanje što je svrha različitih razvoja koja razvoju daje smisao, bez čega je nemoguće osmisliti djelotvornu strategiju razvoja i ulogu obrazovanja u njoj.

Može se primijetiti da se u razvojnim studijama manje istražuje doprinos obrazovanja razvoju osobe, odnosno ljudi, makar se razvoj osobe ističe kao primarni cilj i razvoja i edukacije. Nedovoljno je istraženo i pitanje odnosa između razvoja osobe i pojedinih dimenzija društvenog razvoja makar se načelno smatra da je razvoj osobe preduvjetom ostalih razvoja. Implicitno se polazi od toga da je obrazovanje glavni generator razvoja osobe i samim tim čimbenik društvenog razvoja. No, pokazuje se da takvi pojednostavljeni odgovori ne daju uvijek dovoljno spoznaja o stvarnom i mogućem doprinosu obrazovanja pojedinom razvoju nužnih za artikuliranje takvih razvojnih strategija koje bi potencijale obrazovanja optimalno iskoristile. Stoga ćemo u pojedinim poglavljima razmotriti moguće odgovore na ta i druga pitanja, relevantna za razumijevanje razvoja i uloge obrazovanja u njemu.

U prvom poglavlju Konceptualizacija osnovnih pojmova određuju se pojmovi čiji se međuođnosi istražuju. To su koncepti obrazovanja (i odgoja) te pojam razvoja, što je neophodno da bismo mogli detaljnije analizirati njihove odnose. S tim u vezi govori se o ciljevima i svrsi razvoja iz čega izlaze i ciljevi obrazovanja kao jednog od čimbenika razvoja. Kao alat za analizu međudjelovanja obrazovanja i razvoja koristi se dijalektički model društvenog razvoja.

U drugom poglavlju Obrazovanje i razvoj osobe detaljno se razmatra djelovanje obrazovanja na razvoj osobe. Ono se utvrđuje za svako područje ličnosti posebno, pri čemu se koriste recentni podaci o heritabilnosti pojedinih osobina o kojoj ovisi “manevarski prostor” za djelovanje obrazovanja i ostalih okolinskih faktora na razvoj osobe. Posebna se pozornost posvećuje heritabilnosti karakternih osobina ličnosti (prosocijalnosti-antisocijalnosti) koja objašnjava ograničenja u djelovanju odgojne i izvanodgojne socijalizacije na socijalno ponašanje.

U trećem poglavlju Obrazovanje i razvoj društva razmatraju se mogući doprinosi obrazovanja gospodarskom, političkom, sociokulturnom i ekološkom aspektu društvenog razvoja. U tom kontekstu više se pozornosti posvećuje djelovanju obrazovanja na ekološki

razvoj te pitanjima nejednake isplativosti različitih vrsta obrazovanja te posrednim socijalnim učincima obrazovanja, što su u nas donekle zanemarena pitanja. Problematizira se ograničavajuće djelovanje postojećeg socijalnog kapitala na društvenu korist od obrazovanja u tranzicijskim zemljama s posebnim osvrtom na hrvatsku situaciju.

U četvrtom poglavlju Znanost o obrazovnim sustavima određuje se pojam znanosti o obrazovanju polazeći od metateorijskih kriterija znanstvenosti. Iz toga izlaze i razlike između pedagogije i znanosti o obrazovanju. Predmet znanosti o obrazovanju, ili točnije, o obrazovnim sustavima, određuje se kao “odnos cilj-sredstvo”. Zato se operativno definiraju ciljevi obrazovanja, a obrazovni sustav kao sredstvo s pomoću kojega se ciljevi obrazovanja trebaju djelotvorno postići. Razmatra se sustavski pristup kao metoda istraživanja u znanosti o obrazovnim sustavima.

U petom poglavlju Kvaliteta obrazovanja određuje se kvaliteta obrazovanja u terminima teorije sustava. Kvaliteta obrazovanja se očituje u izlazima, ishodima i učincima obrazovanja dok su ulazi u sustav i transformacijski procesi u njemu čimbenici o kojima kvaliteta obrazovanja ovisi. Čimbenici kvalitete osnovnog obrazovanja razmatraju se uz pomoć teorije kurikuluma. Na temelju uvida u zakonitosti uspješnog učenja i poučavanja objašnjava se optimalna struktura obveznog obrazovanja s posebnim osvrtom na nedostatke rane horizontalne diferencijacije. U tom kontekstu analiziraju se prednosti i nedostaci dva moguća modela produžavanja obveznog obrazovanja u Hrvatskoj.

U šestom poglavlju Reforma obrazovanja razmatra se sam koncept reforme obrazovanja u odnosu na druge promjene obrazovnog sustava koje nisu reformske. S tim u vezi analiziraju se okolnosti i uvjeti koji trebaju biti ispunjeni za pokretanje i uspješno izvođenje reforme obrazovanja, s posebnim osvrtom na problem kapaciteta sustava za provođenje reforme. Navode se zajednički elementi obrazovnih reformi u Europi s osvrtom na reforme u tranzicijskim zemljama. Prikazuju se modeli stratejskog planiranja promjena obrazovnog sustava koji su primjereni složenosti reformskih zahvata i kapacitetu sustava za njihovo provođenje.

## **2.1. TRANSLATION OF SOURCE TEXT 1**

Nikola Pastuović

### **EDUCATION AND DEVELOPMENT**

How education develops people and changes society,  
and how society impacts education

Institute for Social Research in Zagreb  
Faculty of Teacher Education, University of Zagreb  
Zagreb, 2012

## **Introduction**

Under the conditions of globalization and international competition, problems of economic and social development are becoming an increasingly important subject of discussion by international organizations dealing with development, a subject of national development policies, a subject of scientific development research. In this context, the developmental role of education is considered, i.e. its possible contribution to individual dimensions of social development. It is indisputable that the developmental potential of education is great, almost decisive, and that the development of science and new technologies is growing to such an extent that it is one of the main pillars of progress. This view is best reflected in the concepts of knowledge society and knowledge-based economy in which knowledge, i.e. education, is regarded as a major development resource. In particular, the role of education in economic growth and development is emphasized, while its contributions to other dimensions of social development are less analyzed. As the development potential of education depends on the achieved level of the economy, the political structure and socio-cultural capital, research into the role of education in development and strategic education planning should also keep in mind the entire social context. Namely, education depends not only on the social needs of education, but also on its capacity to meet them.

Developmental expectations in relation to education have fluctuated over the past decades. The aspirations of the sixties that were fueled by the discoveries of American education economists on the contribution of educational investments to the economic growth of the United States, have not been realized in countries that were planning to solve their economic lag with generous investments in the education of their population.. Education outcomes were not fully exploited in some subsystems of its environment. The most educated people abandoned such environments and left the countries where they gained quality higher education and thus contributed to the progress of developed rather than the underdeveloped countries. It is obvious that education is so strongly contextualized that its effects depend on the synergistic activity of other parts of society, thus educational reforms without social ones do not meet expectations.

Another reason why the sixties have become a sort of disappointment in education is the increasingly rapid obsolescence of knowledge gained through education. The half-life of certain knowledge in science-based professions shortened to under five years, so the economy was less and less satisfied with the quality of educated people who had been employed. There have been more open discussions about the education crisis which is starting to take on the characteristics

of a world education crisis due to its global distribution. This sparked a debate in the working bodies of UNESCO about the very foundations of education and led to a redefinition of its concept. The main conceptual innovation consisted of formulating the idea of lifelong learning as a response to accelerated global technological, economic, but also political and cultural changes. The idea being promoted is that learning should last a lifetime, even if you can't spend your whole life going to school. That is why lifelong learning, in addition to education, is achieved through non-formal education and informal learning. This, in turn, has led to the reconceptualization of education that focuses on mediating knowledge with longer half-life, while specific knowledge of less transferable value is mediated through other forms of lifelong learning. As a logical consequence, the field of adult education has been affirmed, since adulthood is the longest life period during which lifelong learning is realized. To conclude, the research on the developmental role of education must also take into account the altered understanding of education itself.

We could conclude that research into the developmental role of education went in two directions; the study of the interaction between education and society, as well as the study of the optimal concept and structure of educational systems and transformation processes in educational organizations that ensure desirable outputs and outcomes of the educational system. This in turn made the student, i.e. the person who is learning, the focal point of the research, because the adequacy of education that is focused on the characteristics of the student depends on their success. The results of psychological research in human development have become important for the evaluation and realization of educational opportunities while forming those personality characteristics that are essential for achieving the social goals of education, and which at the same time contribute to the development of a person. Since man is the main actor of development, knowledge of the structure of human personality and knowledge of the legitimacy of its development has become relevant for determining and for achieving other goals of social development. So far, this has been the most neglected area of development research.

In order to assess the realistic expectations of educational development, it is first and foremost necessary to define the very concept of development and its objectives and purpose. As the developmental phenomenon is multidimensional, it is necessary to identify its main aspects: economy, politics and sociocultural capital. As certain developments are in interaction, assisting or restricting each other, it is necessary to disclose their possible interactions. Education is considered to be an important developmental factor of all developmental

dimensions, so its action should be seen in the context of interactions between the developmental dimensions.

Particular attention should be paid to the interdependence of the quality of human resources, namely the quality of human capital and certain aspects of social development, as education through social development can only operate by improving the quality of human resources. However, human resources do not generate development automatically, so with that in mind the question raised is which are the facilitating, that is, restricting factors on which the social "profitability" of education depends? The unequal efficiency of education in different social circumstances, but also within the same system, can partly be explained by differences in socio-cultural capital, which is becoming an important concept in the theory of development. But beyond these issues, the key question is what is the purpose of various advances that give development a meaning; without that it is impossible to devise an effective development strategy and the role of education in it.

Although human development is highlighted as the primary objective of both progress and education, it may be noted that development studies are less focused on studying the contribution of education to the development of a person, that is, of people. The issue of the relations between human development and certain aspects of social development is insufficiently explored, although it is fundamentally considered that human development is a prerequisite for other developments. It is implied that education is the main generator for human development and is thus a factor of social development. However, such simplified responses do not always give enough insight into the actual and potential contribution of education to individual development necessary for the articulation of such development strategies that would make optimal use of educational opportunities. Therefore, in some chapters, we will consider possible answers to these and other issues, relevant for understanding development and the role of education in it.

In the first chapter, *Conceptualization of the basic terms*, terms whose interrelations are explored are defined; the concepts of education (and upbringing) and development, which is necessary for a more detailed analysis of their relations. In that regard, the objectives and the purpose of development are discussed, and from that, the goals of education as a factor of development arise, *A dialectic model of social development* is used as a tool to analyze the interaction of education and development.

The second chapter, *Education and human development*, examines in detail the impact of education on human development.

It is determined for each personality trait separately, using recent data on the heritability of individual traits, on which the action parameter in the field of education and other environmental factors for human development depends. Special attention is paid to the heritability of character traits (prosociality-antisociality) which explains the limitations in the functioning of educational and non-educational socialization on social behavior.

The third chapter, *Education and society development*, discusses the possible contributions of education to the economic, political, sociocultural and ecological aspects of social development. In this context, more attention is paid to the impact of education on eco-development and to the uneven cost-effectiveness of different types of education, as well as the indirect social impacts of education, which are somewhat neglected topics. The restrictive effect of existing social capital on the social benefit of education in transition countries is being discussed, with particular emphasis on the situation in Croatia.

The fourth chapter, *Educational systems science*, defines the notion of education science based on the metatheory criteria of science. This makes the difference between pedagogy and education science. The subject of education science, or rather of educational systems, is defined through the interrelations between aims and means. Thus, aims of education are determined operationally, and the education system as a means by which the aims of education must be effectively achieved. *The systematic approach* is considered as a method of research in the educational systems science.

The fifth chapter, *Quality of education*, defines education quality in terms of system theory. The quality of education is manifested in the outputs, outcomes and effects of education, while the system's inputs and transformation processes in it are factors on which the quality of education depends. The quality factors of primary education are considered with the help of curriculum theory. Based on the insight into the legitimacy of successful learning and teaching, the optimal structure of compulsory education is explained with particular emphasis on the shortcomings of early horizontal differentiation. In this context, the advantages and disadvantages of two possible models of extending compulsory education in Croatia are analyzed.

In the sixth chapter, *Education reform*, the very concept of education reform is considered in relation to other non-reformative changes in the educational system. In that regard, the circumstances and conditions that must be met for the initiation and successful implementation of the education reform are analyzed, with particular emphasis on the problem of system capacity to carry out reforms. The common elements of educational reforms in Europe are outlined, with reference to reforms in transition countries. The models of strategic planning of changes in the education system, corresponding to the complexity of reforms and the system capacity for their implementation, are presented.



## 2.2 Commentary and analysis

One of the most challenging things I encountered with when translating this text was achieving cohesion between sentences that were not quite understandable and connected even in the Croatian source text.

To start with, I had trouble with translating the term *međunarodna utakmica*, which, keeping in mind the overall context of the source text, would not make sense if translated literally *international game*. I deliberated between choosing one of the following terms: *international competition*, *international match* and *international contest*. Since it is defined as *nadmetanje* in the dictionary, and that, in my opinion, corresponds best with the original meaning, I ended up translating it as *international competition*.

Furthermore, when translating the sentence *U prvom poglavlju **Konceptualizacija osnovnih pojmova** određuju se pojmovi čiji se međuodnosi istražuju* I had to do an inversion of the sentence and write it in a passive voice: *In the first chapter, **Conceptualization of the basic terms**, terms whose interrelations are explored are defined*. When translated literally, without rearranging the sentence, it is evident that the sentence is, in fact, translated directly from Croatian, and thus makes it sound clumsy.

Another term that was difficult to translate was *manevarski prostor*. While looking up the dictionary the word *manevarski* is translated as *room for maneuver*, but that still did not make perfect sense to me. The term *parameter* is defined as ‘‘a set of facts or a fixed limit that establishes or limits how something can or must happen or be done’’ on the Online Cambridge Dictionary, so I decided to go with the term *action parameter* since it made more semantic sense in the English language.

It is interesting that in German the term *manevarski prostor* is translated as *Spielraum*, and the term *Spiealraum* in Croatian means *djelokrug*, which is again translated differently into English (scope, field).

All in all, I found it challenging to remain true to the original text, while achieving perfect cohesion by splitting up or connecting sentences. The problems were connected to the stylistic form of the source text, i.e. the stylistic differences between the two languages. So, for the translation to be coherent and understandable, it was necessary to split the original sentences into smaller syntactic units, or to connect the sentences in a way that makes sense in the English language.

The text was more demanding than I expected it to be, and it required quite a few alterations, revision and adjustments. Translating the terms themselves did not pose a big problem, as did understanding the overall meaning of the sentences.

### 3. SOURCE TEXT 2

#### NOVI OBLIK E-POSLOVANJA KROZ 3D PRINT TEHNOLOGIJU

*Olivia – Silvana Prlić, Andriana Lacković*

*Tehničko veleučilište u Zagrebu*

*Podravka d.d.*

##### 1. UVOD

Ideja principa rada na kojem funkcioniraju 3D printeri pojavila se još tijekom sredine osamdesetih godina, od tada se razvija i vrlo je napredovala. Danas 3D printeri mogu koristiti više različitih materijala odjednom i stvarati vrlo kompleksne predmete. Postoje profesionalni 3D printeri koji imaju vrlo visoku cijenu, a na tržištu su se počeli pojavljivati i komercijalni 3D printeri pristupačnije cijene. U e-poslovanju 3D print tehnologija uvela je novi model e-poslovanja pod nazivom EP 3D print. Ova tehnologija ima poseban utjecaj u poslovanju u segmentu SCM-a (engl. Supply Chain Management) odnosno upravljanjem opskrbnim lancima i on-line trgovanju. Novi koncept prodaje roba i usluga koristeći 3D printing tehnologiju omogućit će stvaranje jedinstvenog proizvoda na globalnom tržištu poštujući ograničenja u kojima se društvo danas nalazi. Tržište 3D printanja je u porastu i u budućnosti se čeka njegov daljnji ubrzani

razvoj, usavršavanje i šire područje upotrebe što će dovesti do proizvodnje većih serija printera te pada njihove cijene. Svi se slažu da će 3D print tehnologija promijeniti svijet oko nas u slijedećih nekoliko godina i kada ona bude cijenom dostupna doživjet će veliki bum u e-poslovanju. Zbog toga je tema ovog rada posvećena promjenama i utjecajima tehnologija 3D tiska na e-poslovanje.

##### 2. UKRATKO O 3D PRINTANJU

3D printanje je aditivni proces izrade trodimenzionalnog predmeta lijepljenjem slojeva materijala jedan na drugi na temelju dizajna napravljenog na računalu pomoću programa za 3D modeliranje. Ima prednosti pred tradicionalnim načinima proizvodnje predmeta jer je bolja iskoristivost materijala zato jer se materijali ne režu, ne bruse, ne buše već se sav materijal iskorištava za izradu predmeta, a zbog toga je moguća i proizvodnja oblika koje je nemoguće proizvesti klasičnim metodama kao na primjer vrlo lake i čvrste konstrukcije koje su dizajnirane posebnim načinom slaganja materijala [1]. 3D printeri mogu koristiti više različitih materijala odjednom i stvarati

vrlo kompleksne predmete, ali njihova mana je u tome da što je predmet koji se želi isprintati kompleksniji i veći, to je dulje vrijeme printanja [2]. Uz to postoji trenutno ograničenje veličine isprintanih predmeta na maksimalno A3 i/ili A4 kocke, nesavršenosti u printanju jer većina isprintanih predmeta ima grubu teksturu zbog metode lijepljenja materijala sloj po sloj, još uvijek imaju visoku cijenu i skupo održavanje, ograničen izbor materijala jer materijali koji se koriste na 3D printerima moraju biti razvijeni posebno za tu namjenu [1]. Većina tih mana se daljnjim razvojem 3D printera mogu ukloniti pa će 3D printanje sigurno biti poboljšano u skoroj budućnosti. S druge strane omogućavaju veću preciznost prilikom izrade predmeta nego klasična proizvodnja, omogućuju personalizaciju predmeta, proizvodnju manjih serija proizvoda, lokalnu proizvodnju uz pomoć datoteka s 3D modelima [1].

### **3. IZRADA 3D MODELA**

Kako bi mogli isprintati predmet pomoću 3D printera, potrebno je izraditi njegov 3D model. Najjednostavnija opcija je kupiti preko Interneta 3D model koji je napravio netko drugi, ali moguće je i izraditi vlastiti 3D model što je kompliciranije jer je potrebno znati 3D modelirati. Najpoznatiji programi za 3D modeliranje su Blender, Google Sketchup, Autodesk 123D, Photomodeler, Agisoft, TopMod3D, K3D

Surf, Rhinoceros 3D, Photoshop i Solidworks. Neki od tih programa rade 3D modele na temelju fotografija, neki omogućuju obradu 3D modela predmeta dobivenih skeniranjem pomoću 3D skenera, a s nekima se modelira od nule, isključivo u programu [3]. Upravo izrada 3D modela je trenutno najveći problem te tehnologije. Trenutno u Hrvatskoj nema mnogo ljudi koji posjeduju to znanje, a aplikacije za izradu 3D modela su dosta komplicirane za korištenje. U tome najviše pomažu Internet stranice koje prodaju dizajne za 3D modele koji se mogu printati. Trenutno su u razvoju jednostavnije aplikacije za izradu dizajna 3D modela jer je krajnji cilj da te tehnologije budu dostupnije. Tako bi i pojedinci koji nisu tehnički obrazovani mogli ostvariti svoje ideje na lak način što bi oslobodilo kreativne mogućnosti [4].

### **4. PRINTANJE 3D MODELA**

Postoji više različitih metoda 3D printanja, a pet najčešće korištenih metoda su FDM, inkjet, SLS i LOM. Najjeftinija i najčešće korištena metoda 3D printanja je FDM (engl. fused deposition modeling). Koristi se u kućnim printerima. Radi na principu da je materijal složen u obliku „koluta žice“ koji se topi i uz pomoć printera stavlja na određeno mjesto, sloj po sloj te tako stvara novi predmet [5]. Nije dobra za izradu detalja, a na gotovim predmetima je vidljivo da su izrađeni pomoću slojeva. Jedina metoda 3D printanja koja može

printati u različitim bojama je Inkjet. Prilikom ovog načina 3D printanja koriste se posebni tekući materijali koji se učvrste pod utjecajem UV svjetla. Ova metoda je brža od FDM metode [6]. SLS (engl. selective laser sintering) je metoda 3D printanja koja za stvaranje predmeta koristi materijale u prahu (metal, plastika, keramika, staklo) koji se tale uz pomoć jakih lasera i u slojevima spajaju u oblike. To je brz način 3D printanja prilikom kojeg se predmeti brzo učvrste i ohlade [5]. Na kraju printanja predmeta preostali prah se kasnije može ponovno koristiti što je vrlo ekonomično [6]. Mana SLS-a je da tako napravljeni predmeti imaju hrapavu površinu te nije jako precizno [7]. LOM (engl. laminated object manufacturing) je 3D printanje kod kojeg se sirov materijal slaže jedan na drugi sloj po sloj nakon čega se reže laserom ili nožem. Uz pomoć ove metode se mogu dobiti materijali slični drvu zbog izgleda kao da imaju godove. Materijali koji se mogu koristiti kod LOM printanja su papir, plastika i metali [8].

## **5. NOVOSTI U TEHNOLOGIJI 3D TISKA**

3D tisak je do sada uspješno korišten u proizvodnji mnogih materijala i predmeta te ima mogućnost primjene u mnogim različitim industrijama, a tržište 3D printera i usluga vezanih uz njih je u stalnom porastu što će se nastaviti i u budućnosti.

Također se očekuje porast potražnje za njima i poboljšanje tehnologije što će dovesti do pada cijena i povećanja njihove dostupnosti prosječnim potrošačima što pokazuje da se u budućnosti može očekivati sve šira upotreba 3D printera te se može pretpostaviti da će za desetak godina postati sastavni dio svakog kućanstva [4]. S obzirom na to da je 3D printanje tehnologija koja se jako brzo razvija, stalno se pojavljuju nove tehnologije, a u zadnjih nekoliko mjeseci pojavio se 3D printer u obliku olovke, uz pomoć 3D printera isprintano je 10 kuća u samo 24 sata, a cijene 3D printera su u padu pa postaju sve dostupniji.

### **5.1. 3D printer olovka**

Lix je prvi 3D printer u obliku olovke (Slika 1). On je poseban po tome što za printanje 3D modela nije potrebno unaprijed dizajnirati 3D model na računalu što znači da nije nužno poznavati programe koji se koriste za 3D modeliranje. Naravno, unatoč tome, kako bi se pomoću njega stvorio koristan predmet koji ima neku svrhu, treba imati znanja o statici predmeta kao i znati crtati. Zato je namijenjen osobama poput dizajnera, arhitekata i stilista. Ovakva olovka 3D printer neće biti jako skupa, predviđa se da će koštati oko 85 funti što je nešto manje od 480 kuna dok će jedno punjenje za nekoliko minuta 3D printanja njome koštati oko sedam funti što je oko 55 kuna [9].



*Slika 1. Predmeti isprintani olovkom Lix*

### **5.2. Sve niže cijene 3D printera**

S napretkom tehnologije i pojavom veće konkurencije u proizvodnji 3D printera, padaju i njihove cijene te postaju sve dostupniji. Tako se na Kickstarteru pojavio Micro 3D printer koji je vrlo jednostavan za korištenje i cijena mu je 249\$ što je oko 1400 kuna. Ovaj projekt je uspio prikupiti mnogo više od traženih 50000 dolara, prikupljeno je više od milijun dolara. Ovi printeri trebali bi se početi isporučivati od kolovoza 2014. godine, a oni jeftiniji primjerci od 249\$ su već rasprodani [11].

**5.3. Noviteti u 3D printanju kuća** U travnju ove godine jedna kineska tvrtka uspjela je pomoću 3D printera isprintati 10 kuća u 24 sata. Kuće koje gradi takav printer nemaju prednost samo u tome što su brzo gotove nego i u cijeni. Izgrađene su većinom od recikliranih materijala pa jedna takva kuća košta manje od 5000 dolara što je oko 27000 kuna. Ovakav način 3D printanja kuća je drugačiji od drugih jer se dijelovi printaju u tvornici zbog veličine 3D printera (6.6 x 10 x 32 m), zatim se transportiraju na

gradilište i sastavljaju na vrlo jednostavan i brz način [12]. S obzirom na brzinu i cijenu ovog načina 3D printanja kuća, ovaj 3D printer bi bio jako dobro rješenje problema do kojeg je došlo ovih dana zbog poplava u Hrvatskoj, Bosni i Srbiji [13].

## **6. NOVI OBLIK E-POSLOVANJA KROZ 3D PRINT TEHNOLOGIJU**

3D printanje se razvija na mnogo načina i vrlo velikom brzinom [14]. Kod novog oblika e-poslovanja koje donosi 3D print tehnologija postavlja se pitanje kako 3D print utječe na SCM (engl. Supply Chain Management) odnosno na upravljanje opskrbnim lancem i logistikom. Što se tu mijenja? Svakako, odgovor leži u tome da će 3D print ubrzati lanac opskrbe SCM-a i da će promijeni logistiku. 3D print učinit će to da će masovna proizvodnja napraviti odmak i ustupiti svoje mjesto ograničenoj proizvodnji koja će isključivo raditi za korisnike. Razlog je vrlo jednostavan. 3D print definitivno nije pogodan za masovnu proizvodnju zbog velikog troška po jedinici proizvoda i sporijeg vremena koje je potrebno za proizvodnju jedinice proizvoda. Na ovaj način 3D print je otvorio vrata malim i srednjim poduzetnicima. Mali i srednji poduzetnici mogu tehnologije 3D printanja koristiti u dva smjera. Jedan je nabava vlastite opreme i njena svakodnevna primjena, a drugi je (u slučajevima povremene potrebe za 3D printanjem) korištenje usluga tvrtki ili institucija koje

moгу pružiti uslugu 3D printanja. Proizvodnja proizvoda sa 3D print tehnologijom je označena kao fleksibilna okretna jer promptno reagira na zahtjeve kupaca. Trošak po jedinici proizvoda može biti veći, ali poanta cijele priče je prvo u smanjenju skladištenja proizvoda na zalihama odnosno primjenom ove tehnologije eliminiraju se nepotrebne zalihe. Zatim, transportni troškovi gotovih proizvoda svode se na minimum, a na području logistike i transporta proizvoda treba naglasiti da proizvodi putuju u digitalnom obliku mrežom dok se mogu proizvoditi lokalno. 3D tehnologija tu ima jaki utjecaj na promijene u e-poslovanju pa se očekuje da ona može imati veći utjecaj nego Internet. Nadalje, 3D print omogućuje izradu po narudžbi i na taj način omogućuje da proizvod može biti blizu potrošača. To predstavlja diferencijaciju proizvoda u procesu lanca opskrbe. Lanac opskrbe uvođenjem 3D print e-poslovanja postat će puno fleksibilniji i prilagođeniji korisniku. Kako to izgleda u praksi možemo ilustrirati praćenjem promjena u on-line trgovanju na primjeru Amazona. Zavaljujući svom partneru tvrtki 3DLT Amazon ima u ponudi moderan nakit i neobične igračke napravljene 3D print tehnologijom od plastičnog materijala te ukrase napravljene od polimera. Prošle godine Amazon je otvorio trgovinu proizvoda izrađenih 3D tiskom. Trenutno stanje u Amazonu je

slijedeće: robu koju ima u ponudi i koju drži na policama skladišta dostavlja kupcima s minimalnim troškom dostave. Ključ svega je da Amazon ne troši novac na izložbeni prostor pa može biti konkurentan sa cijenom proizvoda. Oni sada rade novi koncept poslovanja 3D print proizvoda koji cilja na smanjenje zaliha proizvoda, a koji će im donijeti značajnije uštede. Koncept se bazira na tome da se 3D print koristi odmah po narudžbi pa se na taj način eliminira skladišni prostor. Amazon cilja na prodaju samog dizajna nekog proizvoda koji kupac poslije otisne na svom printeru kod kuće. I na kraju oni u ponudu u ovom konceptu stavljaju prodaju 3D printera i prodaju materijala za punjenje tih 3D printera. Brzina na koji način 3D print mijenja poslovanje je za sada malo kaotična. Problem koji je uočen je prodaja digitalnih datoteka i izrada digitalnih datoteka za upotrebu u 3D printu. Vezano uz komplicirane programe u kojima se izrađuju modeli za 3D printere, e-poslovanje bi moglo funkcionirati na način da se prodaju datoteke s dizajnima za 3D modele preko Interneta. Nakon kupnje dizajna korisnici si mogu kod kuće na 3D printeru isprintati predmete. Time bi se lakše prodavali proizvodi preko Interneta jer ne bi bilo dostave koja je često dugotrajna, a i proizvodi bi bili jeftiniji jer ne bi bilo troškova dostave. Isto tako u ovom obliku poslovanja javlja se problem

kod upotrebe i dostupnosti više različitih materijala za upotrebu kod 3D printa. Za sada jako dobro funkcionira plastika kao materijal za izradu proizvoda, no upotreba ostalih materijala ne smije se zanemariti. Dakle, u budućnosti se očekuje sve šira upotreba 3D printera. Znanstvenici predviđaju da će se u iduće dvije godine početi koristiti u IT odjelima, prodaji, marketingu i višem korporativnom menadžmentu. Za očekivati je da će razvojem 3D printeri postajati sve više zastupljeni i u kućanstvima pa se tako predviđa da će za desetak godina postati sastavni dio svakog kućanstva [16]. Sve te promjene koje su donijeli 3D printeri doveli su do promjena u poslovanju tvrtki. Više neće biti potrebe za dostavom proizvoda, sve će se printati što će smanjiti cijene proizvoda. Bit će moguće npr. u Hrvatskoj kupiti neki proizvod (odnosno dizajn za 3D model) iz Australije i on će se malo kasnije isprintati na 3D printeru, bez dugotrajnog postupka slanja brodom ili avionom i prelaženja mnogobrojnih kilometara što otvara nove prostore za širenje e-poslovanja. E-poslovanje se trenutno najviše provodi interno u tvrtkama, a 3D printeri otvaraju mogućnost da tvrtke koje imaju proizvode koji se dostavljaju klasičnim putem u trgovine i prodaju na klasičan način, počnu provoditi svoje poslovanje u potpunosti elektroničkim putem. To će smanjiti cijene proizvoda i biti

dobro za kupce, ali imat će loš utjecaj na tvrtke koje se bave dostavom. Negativne posljedice do kojih će doći zbog većeg korištenja 3D printera su i mogućnost skeniranja i printanja duplikata ključeva, mogućnost jednostavne proizvodnje oružja i droge kod kuće, povreda autorskih prava, skeniranje i 3D printanje različitih jednostavnijih predmeta može ugroziti proizvođače skeniranih proizvoda (kao što se danas dešava s glazbenom i filmskom industrijom) [2]. Sa sigurnošću možemo tvrditi daje 3D print napravio ogromnu revoluciju u e-poslovanju, revoluciju u industriji i e-commercu i da se pojavio novi model e-poslovanja koji nosi naziv EP 3D Print.

## **7. ZAKLJUČAK**

Tržište 3D printera i usluga vezanih uz njih je u stalnom porastu što će se nastaviti i u budućnosti. Također se očekuje porast potražnje za njima i poboljšanje tehnologije što će dovesti do pada cijena i povećanja njihove dostupnosti prosječnim potrošačima. Daljnjoj popularizaciji 3D printera uvelike će doprinijeti povećanje palete i kvalitete novih materijala za 3D printanje što dovodi i do razvijanja novih, kvalitetnijih i učinkovitijih tehnologija 3D printanja kao i njihova pojeftinjenja. Mogućnost da napravite proizvod od različitih materijala, boja i čvrstoća je veliki izazov 3D printanja za sad. U budućnosti se može očekivati sve šira upotreba 3D



printera te se može pretpostaviti da će za desetak godina postati sastavni dio svakog kućanstva. To će dovesti do smanjenja potrebe za dostavom proizvoda što će smanjiti cijene proizvoda, ali i loše utjecati na tvrtke koje se bave dostavom. 3D printeri će promijeniti život u mnogim aspektima, od pojeftinjenja nekih proizvoda, do jeftinije i brže gradnje, personalizacije proizvoda, unapređenja školstva i razvoja medicine. Sve to će otvoriti mogućnost razvijanja kreativnosti kod ljudi, a 3D dizajneri će postati vrlo traženi na tržištu rada. Popularizacija Interneta otvorila je prostor za e-poslovanje i na taj način kreirala prvu generaciju e-poslovanja. Druga generacija e-poslovanja nastala je popularizacijom mobitela koji su iznjedrili mobilno poslovanje, a smanjenjem cijena jakih servera i memorijskog prostora za spremanje podataka se otvorio prostor za Cloud Computing poslovanje. Može se zaključiti da će popularizacija 3D printera i tehnologija 3D printa otvoriti prostor za nove mogućnosti u e-poslovanju druge generacije i nove načine prodaje i plaćanja proizvoda. Taj novi model e-poslovanja EP 3D Print unijet će veliku revoluciju u poslovanju, a područje primjene e-poslovanja će se proširiti i u budućnosti dalje razvijati

### **3.1. TRANSLATION OF SOURCE TEXT 2**

#### **NEW FORM OF E-BUSINESS THROUGH 3D PRINT TECHNOLOGY**

*Olivia - Silvana Prlić, Andriana Lacković*

*Technical University of Zagreb*

*Podravka d.d.*

##### **1. INTRODUCTION**

The idea of the technical principles of 3D printers' functioning appeared in the mid-eighties and since then it has developed and flourished. Today, 3D printers can use multiple different materials at once and create very complex objects. Besides the professional 3D printers that have a very high price, there are also more affordable commercial 3D printers that are in the market. In e-business, 3D print technology has introduced a new e-business model called the EP 3D print. This technology has particular impact on business in the SCM (Supply Chain Management) segment, i.e. the management of supply chains and on-line trading. The new concept of selling goods and services using 3D printing technology will enable the creation of a unique product on the global market, while respecting the limitations of today's society. The 3D printing market is on the rise, and in the future, it is expected to further accelerate its

development, improvement and wider use, which will lead to the production of larger series of printers and price reduction.

Everyone agrees that 3D printing technology will change the world around us in the next few years, and when it is affordable, it will experience a big boom in e-business. That is why the topic of this paper is focused on the changes and impacts of 3D printing technology on e-business.

##### **2. BRIEFLY ABOUT 3D PRINTING**

3D printing is an additive process of creating a three-dimensional object by gluing layers of material onto each other based on a design made on a computer using a 3D modeling program. It has advantages over traditional manufacturing methods, because of its better use of materials; the materials are not cut, grinded, nor drilled. Instead all the material is used to make objects, and thus it is possible to make shapes that cannot be created by classical methods, for example, very light

and solid constructions designed in a way

3D printers can use several different materials and create very complex objects, but their disadvantage is that the more complex and larger the object, the longer the printing time [2]. In addition, there is a current limit on the size of the printed items at a max of A3 and/or A4 cubes, printing imperfections (due to the method of gluing materials layer by layer resulting in a rough texture of the printed items), high cost and expensive maintenance, limited choice of materials (since the materials used on 3D printers must be designed specifically for this purpose) [1]. Most of these flaws can be removed by further developing 3D printers, so the process will certainly be improved in the near future. On the other hand, they provide greater accuracy when creating objects than traditional manufacturing, they allow you to personalize objects, to produce smaller quantity of serial products, local production with 3D model files [1].

### **3. MAKING 3D MODELS**

To be able to print an object using a 3D printer, you must create a 3D model of the object. The easiest option is to buy a 3D model made by someone else through the Internet, but you can also make your own, which is more complex as it is necessary to know 3D modelling. The most famous 3D modeling programs are Blender, Google

of laying the material [1]

Sketchup, Autodesk 123D, Photomodeler, Agisoft, TopMod3D, K3d Surf, Rhinoceros 3D, Photoshop and Solidworks. Some of these programs make 3D models based on photos, some allow you to process 3D models of objects obtained by scanning with a 3D scanner, and some are modeled from scratch, exclusively in the program [3]. It is the creation of 3D models that is currently the biggest problem of this technology. At the moment, there are not many people in Croatia who possess the required knowledge, and applications for creating 3D models are quite difficult to use. The most helpful are web sites that sell designs for 3D models that can be printed. Currently applications for designing 3D models are in development, as the ultimate goal is to make these technologies more accessible. Thus, individuals who are not technically educated could carry out their ideas in an easy way, which would allow space for creative opportunities [4].

### **4. PRINTING 3D MODELS**

There are several different 3D printing methods, and the five most commonly used are FDM, inkjet, SLS, and LOM.

The cheapest and most common 3D printing method is FDM (Fused Deposition Modeling), which is used in home printers. It works in a way in which the material is stacked in the form of a wire reel that melts

and with the help of the printer is put in a certain place, layer by layer and thus creates a new object [5]. It is inadequate for making details, and on finished objects it is evident that they are made in layers.

The only 3D printing method that can print in different colors is Inkjet. In this 3D printing mode, special liquid materials that solidify under the influence of UV light are used. This method is faster than the FDM method [6]. SLS (Selective Laser Sintering) is a 3D printing method that uses powder materials (metal, plastic, ceramics, glass) to create objects, which are melted using strong lasers, and merged, in layers, into shapes. This is a quick 3D printing method; objects harden and cool quickly [5]. When finished printing, the remaining powder can be reused, which is very economical [6]. One drawback of the SLS is that it is not very precise and so-made objects have a rough surface [7]. LOM (persistent laminated object manufacturing) is 3D printing in which raw material is laid on one another, layer by layer, after which it is cut by laser or knife. With this method, wood-like materials can be obtained because of their visual resemblance to tree-rings. Materials that can be used for LOM printing are paper, plastic and metals [8].

## **5. NEWS IN 3D PRINTING TECHNOLOGY**

3D printing has so far been successfully used for the manufacture of many materials

and objects and it has the ability to be used in many different industries. The market for 3D printers and related services is steadily growing, which will also continue in the future. It is also expected that 3D printers will increase in demand and technology will improve, leading to lower prices and increased availability for average consumers, indicating that in the future we can expect an increasing use of 3D printers. We can assume that in ten years they will become an integral part of every household [4]. Given that 3D printing is a rapidly evolving technology, new technologies are constantly emerging; over the past few months, a pencil-shaped 3D printer has appeared, 10 houses have been printed in just 24 hours using a 3D printer, and the prices of 3D printers are in decline, hence making them more accessible.

### **5.1. 3D printer pencil**

Lix is the first pen-shaped 3D printer (Picture 1). It is special in that you don't have to predesign a 3D model on your computer, which means that it is not necessary to know the programs used for 3D modeling. Of course, despite this, in order to use it to create a useful item that has a purpose, you should know how to draw and have knowledge of the object's statics. That's why it is intended for people like designers, architects and stylists. This 3D pencil printer will not be very expensive; it is expected to cost about 85

pounds, which is slightly less than 480 kunas. While a single charge for a few minutes of 3D printing will cost around seven pounds, which is about 55 kunas [9].



*Picture 1. Objects printed with a Lix pencil*

### **5.2. Dropping prices of 3D printers**

The prices of 3D printers are dropping and thus are becoming more accessible, due to the advancement of technology and the emergence of greater competition in manufacturing. This project has managed to collect much more than the requested 50,000 dollars; it has collected more than a million dollars. These printers should start shipping in August 2014, and the cheaper samples (\$ 249) are already sold out. [11]

### **5.3 Novelties in 3D house printing**

In April of this year, a Chinese company managed to print 10 houses in 24 hours using 3D printers. Houses built by such a printer have an advantage in price and are quickly constructed. They are built mainly from recycled material, so one such house costs less than \$ 5,000, which is about 27,000 kunas. This way the process of 3D house printing is different from others as the parts are printed in the factory due to the size of the 3D printer (6.6 x 10 x 32 m),

then they are transported to the construction site and assembled in a very simple and quick way [12]. Considering the speed and cost of this 3D house printing method, the 3D printer would be a very good solution to the problem caused by floods in Croatia, Bosnia and Serbia these days [13].

## **6. A NEW FORM OF E-BUSINESS THROUGH 3D TECHNOLOGY**

3D printing is evolving in many ways and at a very high speed [14]. With the new form of e-business brought by 3D print technology, the question that arises is how 3D printing affects SCM (Supply Chain Management), i.e. supply chain management and logistics. What changes here? Certainly, the answer lies in the fact that the 3D print will accelerate the SCM supply chain and change the logistics. 3D printing will distance mass production and give way to limited production that will work exclusively for users. The reason is very simple. 3D printing is definitely not suitable for mass production because of the high cost per unit of product and the slower the time it takes to produce the product unit. Thus, 3D print has opened the door to small and medium-sized entrepreneurs; they can use 3D printing technology in two ways. The first one is the purchase of own equipment and its daily use, and the second is (in case of occasional 3D printing needs) the use of company services or institutions that can provide 3D printing services.

Product manufacture with 3D print technology is marked as flexible because it responds promptly to customer requests. Cost per unit of product may be higher, although the point of the whole story is in reducing the storage of products in stock, i.e. by using this technology, unnecessary stocks are eliminated. Then, the transport costs of finished products are reduced to a minimum. In the field of logistics and transport of products it should be emphasized that products travel in digital form over the internet, while they can be produced locally. 3D technology has a strong impact on changes in e-business, so it is expected that it can have an even greater impact than the Internet. Furthermore, 3D print allows customized production and thus brings the product closer to the customer. This represents the product differentiation in the supply chain process. By introducing 3D print e-business the supply chain will become much more flexible and user-friendly. By using tracking changes in online trading on the example of Amazon we can illustrate how it all looks in practice. Thanks to its partner, 3DLT, Amazon offers stylish jewelry and unusual toys made of plastic by using 3D printing technology, as well as polymer ornaments. Last year, Amazon opened a store of 3D-printed products. Amazon's current situation is the following: the offered goods that are on their storage shelves are shipped

to customers with a minimal delivery cost. The key to everything is that Amazon doesn't spend money on the exhibition area, so it can be competitive with the price of the product. They are now working on a new concept of 3D-print product that targets the reduction of product stocks, which will bring them significant savings. The concept is based on the fact that 3D print is used immediately on order and thus eliminates storage space. Amazon is aiming to sell the very design of a product that a customer subsequently prints on their printer at home. This concept finally offers the sale of 3D printers and of materials to fill these 3D printers. The speed at which 3D printing changes business is still a bit chaotic. The problem that has been noticed is selling digital files and creating them for use in 3D printing. E-business could work by selling design files for 3D models over the Internet, due to complex programs in which 3D printer models are created. After purchasing a design, users can print objects at home on a 3D printer. This would make it easier to sell products over the Internet because there would be no long-lasting deliveries and the products would be cheaper as there would be no shipping costs. In addition, in this form of business, there is a problem with the use and availability of a number of different materials used in 3D printing. For now, plastic works very well as product-making

material, but the use of other materials must not be neglected. Therefore, the use of 3D printers is expected to increase in the future. Scientists predict that in the next two years it will be used in IT departments, sales, marketing and corporate management. It is to be expected that, with development, 3D printers will become more and more represented in households, and therefore it is anticipated that in 10 years they will become an integral part of every household [16]. All these changes brought on by 3D printers have led to changes in the business of companies. There will no longer be need for product delivery; everything will be printed, which will reduce product prices. For example, in Croatia, it will be possible to purchase a product (i.e. design for a 3D model) from Australia, and it will be printed on a 3D printer soon after, without the long-lasting process of shipping by boat or plane (and crossing the long distance), which opens up new space for e-business expansion. Currently, e-business is most actively implemented within companies, and 3D printers open the possibility for companies that have products that are delivered and sold in stores (the classic way), to conduct their business entirely in electronic form. This will reduce product prices and be good for customers but will have a bad impact on delivery companies. The negative consequences that may arise due to the greater use of 3D printers are the

ability to scan and print duplicate keys, the ability to easily produce weapons and drugs at home, copyright infringements, scanning and 3D printing of various simpler objects, which can endanger manufacturers of scanned products (as it happens today with the music and film industry) [2]. We can say with certainty that 3D printing has made a huge revolution in the field of e-business, a revolution in the industry and e-commerce, and that a new e-business model called EP 3D Print has emerged.

## **7. CONCLUSION**

The market for 3D printers and related services is growing steadily, which will continue in the future. Improvement in technology and increase in demand (for 3D printers) is also expected, which will lead to a drop in prices and increased availability to average consumers. The further popularization of 3D printers will greatly enhance the palette and the quality of new 3D printing materials, leading to the development of new, better and more efficient 3D printing technologies with lower prices. The ability to make a product from a variety of materials, colors and firmness is currently a great challenge for 3D printing. In the future, the widespread use of 3D printers can be expected, and it can be assumed that in about ten years it will become an integral part of each household. This will reduce the need for product delivery, which will lower product

prices, but will also have a negative impact on delivery companies. 3D printers will change our life in many aspects; from products becoming cheaper, to cheaper and faster construction, personalization of products, improving education, and development in the field of medicine. All of this will open up the possibility of developing creativity in people, and 3D designers will become highly sought after in the labor market. Popularization of the Internet has opened up space for e-business and thus created the first generation of e-business. The second generation of e-business emerged from the popularization of mobile phones, which gave rise to mobile business. And the decline in prices for strong servers and storage space opened up space for the Cloud Computing business. It can be concluded that the popularization of 3D printers and 3D printing technology will open up space for new opportunities in second generation e-business, and new ways of selling and paying for products. This new e-business model of EP 3D Print will make a major revolution in business, and, with that, the scope of e-business will expand and further evolve in future.



## 3.2. Commentary and analysis

While translating this article, a certain vocabulary and terminology was required to properly render the source text into the target language

The most difficult aspect of translating this text was the specific terminology that was used in the source text and that it is connected to modern technology and the method of 3D printing. This required consulting similar literature and looking up texts that were connected to the topic in hand.

To start with, I had difficulty with the following sentence: *Ima prednosti pred tradicionalnim načinima proizvodnje predmeta jer je bolja iskoristivost materijala zato jer se materijali ne režu, ne bruse, ne buše već se sav amterijal iskorištava za izradu predmetam a zbog toga je moguća i proizvodnja oblika koje je nemoguće proizvesti klasičnim metodama kao na primjer vrlo lake I čvrste konstrukcije koje su dizajnirane posebnim načinom slaganja materijala.*

This sentence is clumsily connected in Croatian, and had to be split up into smaller units, which led to more coherence and syntactical flow of the sentence.

I decided to translate it as: *It had advantages over traditional manufacturing methods, because of its better use of materials; the materials are not cut, grinded, nor drilled. Instead all the material is used to make objects, and thus it is possible to make shapes that cannot be created by classical methods, for example, very light and solid constructions designed in a way of laying the material.*

I decided that it was best to split up the sentences and use a semicolon for a serial list, and thus make the sentences as natural sounding as possible in the English language.

Furthermore, I had trouble with translating *A3 i/ili A4 kocke*, because I could not find a corresponding semantic meaning and the right term in the target language. I decided to translate it literally as *cubes* (due to the fact that the text is about 3D print, which makes it possible that

the model used is a 3D cube) , because it is possible that the original Croatian term was also translated literally from another language.

Also, it was challenging to translate the following sentence without making drastic alterations and changes: *Uz to postoji trenutno ograničenje veličine isprintanih predmeta na maksimalno A3 i/ili A4 kocke, nesavršenosti u printanju jer većina isprintanih predmeta ima grubu teksturu zbog metode lijepljenja materijala sloj po slok, još uvijek imaju visoku cijenu i skupo održavanje, ograničen izbor materijala jer materijali koji se koriste na 3D printerima moraju biti razvijeni posebno za tu namjenu.*

I immediately noticed that I would have to make quite a few changes and that the sentence could not be directly translated, nor with the same word order.

The thing I did first was split up the sentences and used brackets as a sort of an explanation: *In addition, there is a current limit on the size of the printed items at a max of A3 and/or A4 cubes, printing imperfections (due to the method of gluing materials layer by layer resulting in a rough texture of the printed items), high cost and expensive maintenance, limited choice of materials (since the materials used on 3D printers must be designed specifically for this purpose).*

In my opinion, I had to make these changes in order to form a meaningful unit in the English language which would convey the same meaning as the original sentences.

Another sentence that I dwelled upon is *Uz pomoć ove metode se mogu dobiti materijali slični drvu zbog izgleda kao da imaju godove.* Firstly, I tried to translate this sentence as *with this method, wood-like materials can be obtained because of their tree-ring visual effect*, but the term *effect* did not sound quite as natural and did not make sense in the context of the English language, so in the end I translated it as *because of their visual resemblance to tree-rings*.

To conclude, I expected this text to be the most challenging to translate because of the technical and specific terms, but it turns out that it was the easiest to understand and therefore the easiest to comprehend and translate without making drastic changes.

## 4. SOURCE TEXT 3

### OBRAZOVANJE UČITELJA I SUVREMENA OBRAZOVNA TEHNOLOGIJA U PODRUČJU ODGOJA I OBRAZOVANJA ZA OKOLIŠ/ODRŽIVI RAZVOJ

*Dunja Anđić*

Filozofski fakultet, Sveučilište u Rijeci, Rijeka, Hrvatska

#### **Uvodna polazišta**

U svjetlu novih globalnih promjena novi mediji i nove tehnologije obrazovanja, odnosno informacijsko-komunikacijske tehnologije (ICT) postavljaju nove zahtjeve pred odgojno-obrazovne sustave. Vrcelj ističe /1/: «Razvoj informacijske tehnologije utječe u mnogim aspektima na obrazovanje, a neki bi utjecaji mogli biti temeljni. Nove tehnologije utječu na prirodu rada... S promjenom tehnologije mijenjaju se i potrebne sposobnosti za obavljanje poslova i ako se na obrazovanje gleda s čisto profesionalnog stajališta – kao osposobljavanje za posao – većina se slaže da će u budućnosti biti potrebna edukacija za cijeli život.». Prema Unesco-u /2/, pojam informacijske i komunikacijske tehnologije (Information and Communication Technologies - ICT), koja se primjenjuje u odgoju i obrazovanju, izrastao je iz prijašnjeg pojma informacijske tehnologije (Information Technologies) i novih tehnologija te predstavlja riječima ogromno područje brzih promjena i brzog rasta. U tom smislu, ICT doprinosi i isticanju novih

pojmovi poput informacijsko-komunikacijske pismenosti i digitalne pismenosti. Informacijske i komunikacijske tehnologije uključuju širok spektar računalnog hardwarea, računalnog softwarea i telekomunikacijskih postrojenja uključujući računalne aparate, od najjeftinijih kalkulatora pa sve do multimedijalnih Dunja Anđić Obrazovanje učitelja i suvremena obrazovna tehnologija u području odgoja i obrazovanja za okoliš/održivi razvoj računala, aparate za projekciju putem računala, lokalna područja i široke zone mreža koji se služe računalnim sistemima i služe ljudima koji komuniciraju putem njih. Špiranec /3/ ističe da je koncepcija društva koje uči prevladala poslije 80-tih godina, a riječ je o «obrazovnom odgovoru na temeljna obilježja i zahtjeve novog doba, čije su osnovne odrednice globalizacija i umrežavanje, brz tehnološki razvitak, gospodarstvo utemeljeno na informacijama, te ubrzano zastarijevanje informacija i znanja.». S tim u skladu, informacijska pismenost i nove tehnologije predstavljaju

ključ za promoviranje koncepcija održivog razvoja, koncepta društva koje uči i cjeloživotnog učenja. Ostvarivost tih globalnih koncepcija uvelike ovisi upravo o sposobnosti pojedinca za snalaženje u beskrajnoj mreži informacija, sposobnosti pronalaženja odgovarajućih vrsta informacija, njihovoj selekciji, sposobnosti vrednovanja i evaluacije, drugim riječima o informatičko-komunikacijskim vještinama. Problematika obrazovanja učitelja u odgoju i obrazovanju za okoliš/održivi razvoj, između ostalog, usmjerena je i **na suvremenu obrazovnu tehnologiju** te njenu primjenu u praksi rada u osnovnim školama, te praksi obrazovanja odnosno u programima profesionalnog obrazovanja i usavršavanja učitelja u odgoju i obrazovanju za okoliš/održivi razvoj. Istraživanja o programima obrazovanja učitelja za okoliš se zadnjih desetak godina posebno bave razvijanjem inovativnijih, interakcijskih i virtualnih modela obrazovanja učitelja, usmjerenih na afirmaciju akcijskoistraživačkog pristupa odgoju i obrazovanju za okoliš. Uzelac i Milotić u procjeni ekoloških sastavnica u programima budućih učitelja zaključuju: «Kvaliteta ekološkog osvješćivanja nastavnika (budućih i sadašnjih) podrazumijeva čitav niz vrsta ekološkog djelovanja: od adekvatnih ekološkoobrazovnih ponuda..., ekološkog preinačavanja studijskih programa u smjeru

veće ekološkoobrazovne kvalitete, promidžbe kvalitativnih ekološko-programskih pristupa.... do ekološkoobrazovnih ponuda na internetu» /4/. Wheeler /5/ ističe da postojeći kvalitativni nedostaci unutar strategija i programa obrazovanja, a posebice profesionalnog usavršavanja učitelja, izviru iz novih i suvremenih zahtjeva u učenju i poučavanju koje učitelji, a posebice učitelji u službi unutar svoje profesije moraju savladati. To su, između ostalog: podjela izvora učenja, podjela prostora za učenje, promoviranje kolaborativnog učenja i promoviranje autonomnog učenja. S tim u svezi Klapan, A. /6/ naglašava: «Tehnologija u obrazovanju odraslih omogućuje da se razvijaju i drugačiji modeli odgojnoobrazovnih procesa s odraslima (tele nastava, nastava uz pomoć računala, nastava u susretu...) u kojima odrasli zajedno sa svojim edukatorima stvaraju bazu podataka i informacija za teorijski i praktičan rad u neposrednim susretima». Na području nastavnih i organizacijskih mogućnosti i oblika obrazovanja učitelja posebno se ističe potreba za obrazovanjem učitelja netradicionalnim oblicima i metodama rada: obrazovanje učitelja online tečajevima, razvijanjem ICT međunarodnih mreža za obrazovanje učitelja, obrazovanje u obliku akcijskih projekata koji podrazumijevaju problem-solving i

suradničke oblike rada, projekti obrazovanja učitelja konceptijski usmjereni na razvijanje modula za učenje i poučavanje te posebice kreiranje tematskih radionica (workshops) namijenjenih obrazovanju učitelja.

### **Multimedijska tehnologija i obrazovanje učitelja za okoliš/održivi razvoj**

Inovativni načini učenja i poučavanja i iskustva učenja računalnom tehnologijom koja zadovoljavaju zahtjeve za akademskom točnošću, eksperimentalnim učenjem i refleksijom istodobno postavljaju nove okvire unutar procesa učenja izazivajući promjenu od učitelja kao centra učenja k učeniku kao centru učenja, a «... pristup procjenjivanju rangira od dominantne pozitivističke paradigme u pedagoško procjenjivanje, od konstruktivističko-orijentirane procjene fokusirane na učenik-centar i učenikvoditelj procjenu.» /7/ Učenje koje se temelji na multimedijskoj tehnologiji i takvom pristupu postaje sve više popularno, što je u skladu s galopirajućom informatizacijom društva i životom u tzv. «informatičkoj eri». Multimedijsko obrazovanje demonstrira principe uspješnog poučavanja i učenja koji su nužno potrebni dio reorijentacije obrazovanja k održivoj budućnosti, odnosno upućuje na činjenicu da ovaj tip stjecanja znanja nastoji osigurati da sam medij za učenje predstavlja i dio

poruke učenja /8/. Kao primjer posebno visoko kvalitetnog iskustva učenja multimedijskom tehnologijom izdvaja se Dunja Anđić Obrazovanje učitelja i suvremena obrazovna tehnologija u području odgoja i obrazovanja za okoliš/održivi razvoj Unesco-v «Learning and Teaching for Sustainable Future», program profesionalnog usavršavanja učitelja i odgojno-obrazovnih djelatnika koji je razvijen u skladu s postojećim zahtjevima nove vizije odgoja i obrazovanja za održivi razvoj. Program posebice stavlja naglasak na nužnost obrazovanja odgojno-obrazovnih djelatnika u području informatičko-komunikacijske tehnologije, računalnu pismenost te stavlja fokus na razmatranje upravo nove uloge učitelja/ odgojno-obrazovnih djelatnika u procese učenja, nastave ICT-om. Ovaj program obrazovanja i profesionalnog usavršavanja u području okoliša/ održivog razvoja, s obzirom na Memorandum o cjeloživotnom učenju /9/, zadovoljava njegove glavne značajke: u poučavanju novih i temeljnih vještina za sve i inovacija u učenju i poučavanju ostvaruje se zahtjev za informatičkom pismenošću, a uz korištenje novih metoda učenja i poučavanja, multimedijske pristupe i ICT tehnologiju. Kao bitna značajka ističe se i približavanje mjesta obrazovanja mjestu stanovanja i rada. Također se omogućuje stvaranje i razvijanje edukativnih mreža, baza

podataka, različitih modela i oblika učenja i poučavanja, iznalaženje alternativnih rješenja, razmjena mišljenja i iskustava, općenite suradnje po pitanjima odgoja i obrazovanja te promoviranje koncepcije održivosti. U svezi s aktivnostima po pitanjima provođenja koncepta ICT u odgoju i obrazovanju u Europi, ističemo sažetak radnog prikaza primjene radnog programa «Obrazovanje i stručno usavršavanje 2010. – Informacijsko-komunikacijska tehnologija u obrazovanju i stručnom usavršavanju» /10/. Zaključci su radne skupine ovog programa da je u Europi i više nego vidljiv napredak u razvoju koncepta ICT-a u obrazovanju, međutim «utemeljivanje odrednica za definiciju ‘dobre obrazovne ICT prakse’ se pokazalo složenim, činjenica da praksa dobro djeluje u jednom okruženju, ne znači da će ista dobro djelovati u drugom.». Razine implementacije ICT-a u odgojno-obrazovne sustave razlikuju se s obzirom na indikatore: uključenje koncepta ICTa u obrazovnu politiku, strategije i organizacijske pristupe, opremu i financiranje, materijale i dr. «Školski sustavi u Europskim zemljama su prihvatili različite organizacijske pristupe za uključivanje ICT u obrazovanje. U nekim zemljama, škole određuju svoje vlastite ICT planove i definiraju strategiju u svezi s infrastrukturom, uslugama, sadržajima, obrazovanjem nastavnika i instruktora».

Projekti koji egzistiraju u obrazovanju i usavršavanju nastavnika diljem Europe su različiti, od primarno orijentiranih na potrebe nastavnika do onih parcijalnih i namijenjenih općoj edukaciji javnosti: u Litvi i Italiji se inicijative za obrazovanje nastavnika orijentiraju prema privrednim granama i sponzorstvima; stručno usavršavanje organizirano od strane javnih ministarstva obrazovanja u Danskoj, Švedskoj i Finskoj je bilo namijenjeno općenito nezaposlenima i potrebama u industriji, a ne primarno za učitelje. Izvješće ističe: «Uočeno je da su u zadnjih 15 godina nastavnici imali prilike slušati tečajeve iz korištenja računala, računskih tablica, te programiranja. Ipak ovo usavršavanje je malo doprinijelo promjenama u razredima, budući da nastavnici nisu primili pedagoška znanja ili primjere konkretizirane na kurikulumu». Međutim «posebna stručna usavršavanja usmjerena na korištenje ICT-a u obrazovanju razvila su se s ciljem zadovoljavanja potreba nastavnika. Osnovne sheme, koje su razvijene u nekoliko zemalja, sada uključuju ekipni rad, kolaborativno učenje, rad usmjeren na procese i stručno vođenje». Kao dobre primjere obrazovne prakse obrazovanja i stručnog usavršavanja nastavnika, ovaj prikaz ističe projekte provedene u Danskoj i Švedskoj pod nazivima Pedagoška IT dozvola odnosno Škole IT koji se izdvajaju

kao integrirani pristupi obrazovanju nastavnika. Iznoseći i analizirajući primjere iz obrazovnih politika europskih zemalja uočen je pozitivan pomak prema razvijanju osnovnih tehničkih vještina, preuzimanju novih uloga u procesima odgoja i obrazovanja, kombiniranju novih obrazovnih okruženja, pristupima i korištenju obrazovnih materijala, kreiranju mreža, razumijevanju kako ICT može nadomjestiti nastavne procese i procese učenja te kolaborativnom učenju i suradnji među nastavnicima i nastavničkim zajednicama. U preporukama za daljnje razvijanje koncepta ICTa u odgoju i obrazovanju je posebno istaknuta uloga nastavnika «Obrazovanje nastavnika je najvažnije područje za uključivanje ICT u obrazovanje. Potrebno je poticati sposobnost nastavnika da se kritički osvrnu na svoju vlastitu praksu.». Kao značajan cilj budućeg razvoja ICT-a je u velikom broju obrazovanih politika europskih zemalja istaknuto omogućavanje odgovarajućeg i unapređivanje postojećeg obrazovanja i stručnog usavršavanja nastavnika. U Republici Hrvatskoj, prema nacionalnom izvješću o provedbi strategije «Informatička i komunikacijska tehnologija – Hrvatska u 21. stoljeću» u

izdanju Ministarstva znanosti i tehnologije /11/, provodi se i financira projekt pod nazivom «ICT kurikulum» čiji je naglašeni cilj stvaranje kataloga obrazovnih sadržaja iz područja informacijske i komunikacijske tehnologije. Istodobno je izrađen program osposobljavanja i odgojno-obrazovnih djelatnika, a «...osnovani su i regionalni centri za informatičku izobrazbu nastavnika (Zagreb, Slavonski Brod, Varaždin, Šibenik, Split i Rijeka),...». U posljednje dvije godine je vidljiv napredak u profesionalnom usavršavanju odgojno-obrazovnih djelatnika, posebice učitelja u osnovnim školama. Program profesionalnog usavršavanja u području informatičkih tehnologija trenutno se provodi u osnovnim školama u Republici Hrvatskoj. Međutim, što se tiče sadržajne dimenzije odgoja i obrazovanja za okoliš/održivi razvoj, još uvijek nisu uočeni dovoljno brzi pomaci u razvijanju informacijsko-komunikacijskih vještina kao metodologije rada u prikupljanju informacija, razvijanju novih procesa učenja na područjima odgoja i obrazovanja za okoliš/održivi razvoj te promoviranju elementa održivosti kao načina života u suvremenom informatičkom društvu.



## 4.1. TRANSLATION OF SOURCE TEXT 3

### TEACHER TRAINING AND CONTEMPORARY EDUCATIONAL TECHNOLOGY IN THE FIELD OF EDUCATION AND CARE FOR ENVIROMENTALISM AND SUSTAINABLE DEVELOPMENT

*Dunja Anđić*

Faculty of Philosophy, University of Rijeka, Rijeka, Croatia

#### **Introductory focal points**

Within the frames of new global changes, new media and new educational technology, that is information and communications technology (ICT), are setting new demands on educational systems. Vrcelj points out /1/:

“Development of information technology influences education in many ways, and some impacts can be fundamental. New technologies affect the nature of work ...

With the change of technology, the required job skills are also changing, and if education is viewed from a purely professional standpoint - as job training - most agree that life-long education will be needed in the future.” According to UNESCO /2/, the concept of information and communications technologies used in education is developed from previous concepts of information technologies and new technologies, thus it represents a vast area of rapid change and growth. In this

regard, ICT contributes to the emphasis of new concepts such as information and communications literacy and digital literacy. Information and communications technologies include a wide range of computer hardware, computer software and telecommunications installations including computer appliances, from the cheapest calculators to multimillion computers, computer screening machines, local areas and wide network zones that use computer systems and are used by people who communicate through them.

Špiranec /3/ points out that the concept of a knowledge society prevailed after the 80's and it is about “the educational response to the fundamental features and requirements of the new age, whose main determinants are globalization and networking, rapid technological development, an information-based economy, and accelerated obsolescence of information and knowledge.”. In this respect, information

literacy and new technology are the key to promoting the concept of sustainable development, the concept of a learning society and lifelong learning. The feasibility of these global concepts largely depends on the individual's ability to navigate in an infinite network of information, the ability to find the appropriate types of information and their selection, the ability to evaluate, in other words, having information and communication skills. Problems of teacher training for environmentalism/sustainable development, among other things, is aimed at both *modern educational technologies* and their application in primary schools, as well as in professional education and teacher training programmes for environmentalism/sustainable development. Research on environmental teacher education programs over the past ten years has been particularly focused on the development of more innovative, interactive and virtual models of teacher education aimed at affirming an action-oriented research for education and care for environmentalism. Uzelac and Milić evaluate the ecological components of future teachers' programmes: 'The quality of ecological awareness of teachers (future and present) encompasses a variety of ecological activities: from adequate eco-education proposals ..., ecological modification/altering of study programmes in the direction of higher ecological quality,

the promotion of qualitative ecological-programming approach .... to eco-education offers on the internet'. Wheeler /5/points out that the existing qualitative deficiencies within education strategies and programmes, especially professional teacher training, are emerging from new and modern learning and teaching demands that teachers must acquire, especially within their profession. These include, among others: sharing of learning resources and learning space, promotion of collaborative and autonomous learning. In this regard Klapan, A. /6/emphasizes: 'The technology in adult education enables the development of different models of educational processes (tele teaching, teaching with the help of computers, class meetings...) in which adults, together with their educators, create a database of information for theoretical and practical work in direct interactions'. In the field of teaching and organizational opportunities and forms of teacher education, special emphasis is placed on the need to educate teachers by using traditional forms and methods of work: education of teachers through online courses, the development of international ICT networks for teacher education, education in the form of action projects that involve problem solving and collaborative forms of work, teacher education projects conceptually oriented towards the development of learning and

teaching modules, and in particular the creation of workshops for teacher education.

### **Multimedia technology and teacher education for environmentalism/sustainable development**

Innovative ways of learning and teaching and computer technology learning experiences that meet the demands of academic accuracy simultaneously set new frameworks within the learning process through experimental learning and reflection, causing a shift from the teacher as the focal point of learning to the student as the focal point of learning. ‘... The approach to assessment ranges from a dominant positivist paradigm in pedagogical evaluation, from constructivist-oriented assessment focused on student-center and student-leader evaluation.’ /7/ Such an approach makes learning based on multimedia technology increasingly popular, which is consistent with the galloping informatization of society and life in the so-called Information Age. Multimedia education demonstrates the principles of successful teaching and learning that are a necessary part of the reorientation of education for a sustainable future, i.e. it points to the fact that this type of knowledge acquisition strives to ensure

that the learning medium itself is a part of the learning message as well /8/.

An example of a particularly high-quality learning experience through multimedia technology is the Unesco ‘Learning and Teaching for Sustainable Future’ professional training programme for teachers and educators, that has developed in line with the existing requirements of a new vision of education for sustainable development. In particular, the programme focuses on the necessity of educating educational staff in the field of information and communications technology, computer literacy and, also, focuses on considering the new role of teachers/educators in learning processes; ICT classes. This programme of education and professional training in the field of environment/sustainable development, taking into account the Memorandum on life-long learning /9/ meets its main features: in teaching new and fundamental skills for all and innovation in learning there is a demand for information literacy, as well as the use of multimedia approaches and ICT technology, along line with new teaching and learning methods. An important feature is also approximating the place of education to the place of residence and work. It also enables the creation and development of education, networks, databases, different models and forms of learning and teaching, finding alternative

solutions, exchanging opinions and experiences, general cooperation on issues of education and promoting the concept of sustainability. In relation to activities on the implementation of the ICT concept in education in Europe, we emphasize the preliminary outline summary of the application of the work programme ‘Education and vocational training 2010. – Information and communications technology in education and vocational training’/10/. Conclusions of the working group on this programme are that in Europe there is a more than visible progress in the development of the ICT concept in education, however, ‘establishing determinants to define good educational ICT practice has proved to be complex; the fact that practice works well in one environment, does not mean that it will work well in another.’ The levels of ICT implementation in educational systems differ with regard to the following indicators: the inclusion of the ICT concept in education policy, strategy and organizational approaches, equipment and financing, materials, etc. ‘School systems in European countries have adopted various organizational approaches to ICT inclusion in education. In some countries, schools determine their own ICT plans and define a strategy related to infrastructure, services, content, education of teachers and instructor’. Projects that exist in education

and teacher training across Europe vary from the ones that are primary oriented to the needs of teachers to those partial and intended for the general public; in Lithuania and Italy Teachers' education initiatives are orientated towards economic branches and sponsorships; vocational training organized by the public Ministries of Education in Denmark, Sweden and Finland was not primarily intended for teachers, but in general for the unemployed and the needs of the industry. The report notes: ‘It has been observed that in the last 15 years, teachers have had the opportunity to attend courses on computer usage, computer tables and programming. However, this training has contributed little to changes in the classroom as teachers have not received pedagogical knowledge or examples specified in the curriculum. However, special training aimed at the use of ICT in education has been developed to meet the needs of teachers. The basic strategies, which have been developed in several countries, now involve teamwork, collaborative learning, process-oriented work and professional guidance’. As a good example of educational practice and vocational teacher training, this outline highlights projects implemented in Denmark and Sweden under the names of Pedagogical IT License, i.e. the IT Schools, which stand out as integrated approaches to teacher education. Considering and

analyzing examples from educational politics of the European countries, a positive shift towards developing basic technical skills has been noted, the adoption of new roles in parenting and education, the integration of new educational environments, approaches to and the use of learning materials, networking, understanding how ICT can substitute teaching and learning processes, collaborative learning and cooperation among teachers and teaching communities. The recommendations for the further development of the ICT concept in the field of education particularly emphasize the role of teachers: "Education of teachers is the most important area for the inclusion of ICT in education. It is necessary to encourage the teacher's ability to critically review their own practice."

In many of the European countries' education policies enabling adequate and improving the existent education and vocational teacher training has been highlighted as a significant goal for future ICT development. In the Republic of Croatia, according to the national report on the implementation of the so called Information and Communication

Technology - 21st Century Croatia strategy, published by the Ministry of Science and Technology, a project called "ICT Curriculum" is implemented and financed, with the stated aim of creating a catalog of educational content in the field of information and communications technology. At the same time, a training programme for the educational staff was created, and... regional centers for information education (Zagreb, Slavonski Brod, Varaždin, Šibenik, Split and Rijeka) were established .... Over the last two years, progress has been made in the professional training of educational staff, in particular primary school teachers.

However, as far as the content dimension of education and care for environmentalism / sustainable development is concerned, there are still not enough rapid advances in the development of information and communications skills as a work methodology for gathering information, developing new learning processes in the field of education and care for environmentalism / sustainable development and promoting the element of sustainability as a way of life in a modern information society.

## 4.2. Commentary and analysis

This final text was the hardest to follow and the most difficult to analyze in Croatian. It consists of complex and long sentences that are in a way abstract.

The first thing I had trouble with was the complex title of the article *OBRAZOVANJE UČITELJA I SUVREMENA OBRAZOVNA TEHNOLOGIJA U PODRUČJU ODGOJA I OBRAZOVANJA ZA OKOLIŠ/ODRŽIVI RAZVOJ*.

Firstly, the title is the most important part of the text because it gives us a hint on what the topic of the article is and what is going to be the focus.

Secondly, some of the terms in the title do not have a literal English equivalent, for example the term *obrazovanje učitelja* could not be literally translated as *teacher education* and the term *odgoj i obrazovanje* could not be translated as *upbringing or nurturing* because it does not have the same semantic meaning. I decided to translate it as *TEACHER TRAINING AND CONTEMPORARY EDUCATIONAL TECHNOLOGY IN THE FIELD OF EDUCATION AND CARE FOR ENVIROMENTALISM AND SUSTAINABLE DEVELOPMENT*.

Throughout the whole text, I debated between using the word-for-word vs. the sense-for-sense translation, i.e. literal or free translation. Even though literal translation is most commonly used due to the fact that the aim of the translation is to provide the best equivalent in the target language, sometimes that is not possible and we have to pay attention that the original meaning is not lost or too far off.

For example, the term *učitelj kao centar učenja* could literally be translated as *teacher as the learning center*, but that does not sound quite as natural as in the source text and it loses its original meaning. So, I thought that the best choice would be to translate it as *teacher as the focal point of learning*, which sounds much more coherent and truer to the target language.

## CONCLUSION

To conclude this thesis, I would like to point out how this was a demanding and challenging task. Firstly, I found it difficult to search and choose the three source texts that I would translate, and I ended up looking up academic articles that deal with the topic of education and technology because I was interested in exploring these topics more thoroughly.

All three of the texts were quite demanding and difficult to comprehend in the Croatian language, The sentences were complex, too long and semantically confusing, so I had to do a lot of splitting up, connecting them together and using inversion in order for them to convey the original message in the target language.

I had trouble with analyzing and modifying the translation, and at the same time bringing it to perfection. That took a lot of rendering, alterations, rethinking and remodeling of the whole layout of the text.

Although I was quite familiar with most of the content and the main topics of the source texts, I still had trouble with finding and choosing the right and most adequate terminology.

All in all, translation is a time-consuming and challenging process that requires a lot of research and dedication for it to be as true as possible to the original source text. With that aside, I must emphasize how it was truly a rewarding process and it helped me understand why we call it *the art of translation*.

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