

Studying Social Micro-worlds as Personal Learning Environments

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Abstract: More than 30 years ago, Seymour Papert formulated his innovative approach to learning as Constructionism, contradicting to the previous approach, which could be called Instructionism. Papert said: "Constructionism and Instructionism are names for two approaches to educational innovation. Instructionism is the theory that says: To get better education, we must improve instruction. Constructionism means: Giving children good things to do so that they can learn by doing much better than they could before. According to the Constructionism principles, the student builds his own micro-world, in which he implements his own cognitive abilities. In contrast, the instructionism is associated with the centralized education and with orientation on the content providing by a central source. Both the instructionism and the constructionism were evolving concurrently during the last three decades, and have thus defined the present situation in the field of learning environments. Today, the brightest example of the instructional approach is known as Massive open on-line courses (MOOCs), which can be considered as a web-based implementation of the original instructional idea. The recent progress of the modern society is linked with the rapid growth of various communication means and, as a result, with unprecedented socialization. Under these circumstances, the Papert's concept of private micro-worlds can be updated, namely these micro-worlds should now include a new, social dimension in their structure. Introducing the social dimension into the concept of personal micro-worlds enriches the constructionist approach and, in turn, gives birth to a new concept of the personal learning environment. The personal micro-world mutates into a so-called social personal micro-world of a networked person. Such social micro-worlds can be seen in the form of various social networks, blogs, Web 2.0 means, etc. The main goal of our research in progress is to study regularities and patterns in the process of designing by students of their social micro-worlds. We observe a group of students from a teachers' training course. The first hypothesis of our study is that a social micro-world can be considered as comprising a set of blocks interconnected according to some rules and corresponding to various channels (blogs, forums, cloud storage, events, content providers etc.). Among these channels there are: Facebook, Wikipedia, YouTube, Dropbox, Evernote, etc. By connecting the blocks, a student creates his/her personal unique social micro-world. The student makes it by means of a so-called mash-up, which arranges the combined functioning of the above blocks. We use a popular mash-up If-This-Then-That (IFTTT) that specifies a set of rules. The student forms his/her set of rules during creating his/her social personal micro-world. The second hypothesis of the study is an idea that the structure and the content of the IFTTT rules contain information about the networked student's behaviour both in general, and the students' Personal Identity On-line in particular. The study of both of the above hypotheses is reflected in a so-called Traffic Pattern, as well as in interviews, which clarify the students' epistemic beliefs about new learning within social personal micro-worlds.

Keywords: Personal Learning Environment, Constructionism, Micro-world, Social micro-worlds, mash-up, Personal Identity On-line

1. Introduction

More than 30 years ago, Seymour Papert formulated his innovative approach to learning, which he termed Constructionism (Papert, 1980), contradicting the previous approach, which could be termed Instructionism. Papert stated: "Constructionism and Instructionism are names for two approaches to educational innovation. Instructionism is the theory that says: To get better education, we must improve instruction. Constructionism means: Giving children good things to do so that they can learn by doing much better than they could before."

According to the principles of Constructionism, the student builds his own micro-world in which he implements his own cognitive abilities. In contrast, instructionism is associated with centralized education and with orientation toward the content by providing a central source. Both instructionism and constructionism evolved concurrently during the last three decades, and have thus defined the present situation in the field of learning environments. Today, the best example of the instructional approach is known as Massive open on-line courses (MOOCs), which can be considered as a web-based implementation of the original instructional idea. The constructionist idea has developed into the Personal Learning Environment (PLE) approach (Mödritscher, 2010), which also widely uses all the modern innovations, especially Web 2.0 technologies and Social Networks.

When comparing the original Constructionism with the recently adapted one, we have to take into account the phenomenon of the Digital Revolution, which took place during this period. The transition of our society to the

Digital epoch serves as an initial point of our study. The digital society has created new ways of human interaction with the natural environment, where artificial interfaces separate individuals from the real world and the distinction between reality and virtuality is blurred (Ivanov, 2006). Under such new conditions, the constructionist idea should be updated. Indeed, the original idea is strongly connected with personalization and even isolation of an artificial micro-world. In contrast, recent micro-worlds built within the Web 2.0-based environment are hybrid micro-worlds that include both traditional artificial components and natural components corresponding to their interaction with the web and different users around the world. In other words, the up-to-date learning environment has become not just personal, which was its main feature before, but increasingly more social, which is the main feature of the recent digital world.

Accordingly, the main objectives of education must now be reconsidered to reflect these tendencies. The most critical point of the newly conceived educational process is the new role of the teacher and the learner (Carolyn & Foster, 2010; Fazal, DeSimone & Lieman, 2010). The teacher is not a single content provider any more. Consequently, the learner becomes increasingly freer to collect knowledge as needed.

Moreover, the latest information and communication technology achievements (wireless broadband, IP, cloud computing, Web 2.0, etc.) have transformed the learning process by making it ubiquitous, which includes supporting the learner's mobility and relaxing the previous strong requirement for learning in a formal class (Dede, 2011).

Our study deals with an up-to-date web-based ubiquitous learning environment (Graf & Kinshuk, 2008). We hypothesize that since such an environment is constructed according to constructionist principles, it reflects the main tendency of the digital world – its social character.

2. Towards Achieving Social Personal Micro-worlds

One of the main features of the educational system of an aspiring industrial society is its social orientation toward formalization and standardization. Concepts such as a formal curriculum, a formal class, and formal lessons were established in the Age of Enlightenment. The classroom-lesson educational system was highly efficient for civil society during the industrial epoch. This system unified and standardized relations between teachers and students and defined the social role of the teacher both in schools and in society. In contrast, education of post-industrial society has undergone a new process in fulfilling the teacher's role (Huber, 1984). This is manifested by the self-learning activity of today's students, who have ubiquitous access to information, in which the teacher is no longer the unique content provider. In post-industrial schools, the classic classroom-lesson system loses its usual significance. The ubiquitous manner of acquiring knowledge changes the conventional meaning of the traditional classroom. We refer to this new type of classroom as a ubiquitous classroom.

2.1 Personal Micro-worlds in a Post-industrial Class

Obviously, original constructionist ideas that strongly correspond to personalization are in conflict with the conventional classroom-based educational process. Papert and his followers perceived the classroom-based system as an obstacle to social progress and as contradicting the fundamental principles of cognition (Papert, 1991). Naturally, this brings to mind a dichotomous view in which society is divided into two portions: 1) conservative, based on a classroom-oriented system, the centralized curriculum, the authoritarian teacher, the omnipotence of the Ministry of Education, and 2) progressive, having students at the centre and symbolizing the rejection of centralism and based on the principle of individualism.

Papert and his followers consider the new liberal school as based on the principles of constructionism (Harel & Papert, 1991; Cakir, 2008). According to these principles, the student builds his own micro-world, in which he implements his own cognitive abilities. In this way, the idea of decentralization and individualization has merged with the ideas of progress, freedom, and creativity. In contrast, the old, classroom-oriented system was associated with centralized authoritarian education that does not take into account the individual student. At the same time, the idea of constructionism was fundamentally related to the use of computers in the classroom. The computer has played a revolutionary role in the constructionist approach, radically changing classroom-based education.

The personal micro-worlds are of major importance, since a student studies the surrounding world when operating in his personal micro-world. Nevertheless, the growth of the personal component in the educational process proceeds concomitantly with a significant reduction in the role of the social component of education. One of the important points of our study lies in understanding the fact that such a highly individualized educational process does not correspond enough to the needs and tendencies of post-industrial society (Huber, 1984). Neglecting the social component in favour of the personal component, although it constitutes the core idea, poses a serious problem. A new society is linked to rapid growth of communications and as a result, with unprecedented socialization. Under these circumstances, private individual micro-worlds that have generated such an impressive breakthrough in the 1980s inevitably have to be transformed into social micro-worlds, though they must also remain personal. Such social micro-worlds can now be seen in the form of various social networks, blogs, Web 2.0 means, etc., which have changed the life styles of millions of people and have become increasingly popular in our daily life. The relationships of our personal and social lives are rapidly changing, which, in turn, affects education both at the level of the educational process and at the level of learning environments.

Digital curation is one of the best examples of personal social micro-worlds. Digital curation (Higgins, 2011) is a process whereby a specific subject is created by selecting digital content suitable to the subject. The curation utilizes web collaboration between participants of similar subject-oriented communities. In order to define the subject, each of the participants (curators) formulates a relevant set of key-words. A specific curation tool forms an input stream comprising a number of records having various relevance and quality levels. The task of each curator is to filter the input stream by approving one record and rejecting another. As a result, every curator forms his/her own output stream that we consider as his/her personal curriculum. One of the most important features of the above process is the fact that curation takes place in the form of collaboration with other curators of similar subjects. Output streams of some curators may, in turn, form input streams of others.

2.2 Personal Identity On-line

Classical virtual micro-worlds (Papert, 1991), when representing a personal learning environment, are often devoid of another important educational component - its social component. This highly significant component has successfully been fulfilled by existing learning environments. But does a student's connection to a global network deprive the learning environments of their individual, private components? Our hypothesis is that the answer to this question is negative. This hypothesis is mainly based on the fact that today's students' identity is formed within the network in a very different way from the conventional one. This new, networked identity is called Personal Identity Online (PIO) (Floridi, 2011).

The concept of PIO is relatively new (Rodogno, 2011; Floridi, 2011). It personifies a specific characteristic of an individual's behaviour in a network environment, which manifests itself in the form of a unique opportunity to form and exhibit the individual's identity differently than is done in reality. The world network of unsurpassed access to data opens up new opportunities for self-expression and the formation of identity. We consider PIO to be a form of personalization that typifies modern learning environments.

The last 30 years has ushered in years of intensive computerization of society and of incredible achievements in information technology. Perhaps the idea that micro-worlds will replace classroom-based education was just an illusion. However, we believe that this is not the case. Here, we show that the constructionist approach successfully describes the coming post-industrial educational system, but that it needs some clarifications.

The first clarification concerns the idea of individualizing the educational system and its corresponding digital resources. We believe that personalization of the learning process is not related to individualizing digital resources. On the contrary, the distribution of educational resources has turned out to be more intensive and that is why distribution has increased personalization. This is especially evident in the phenomenon of "cloud computing" in education (Sultan, 2010; Geth, 2010).

The second clarification concerns the intimacy of the educational process. 30 years ago we already saw that personalization of the learning process is strongly connected with expressing and forming the learner's personal identity. Today we extend this concept by introducing PIO - an identity that a user establishes in on-line communications – the concept that constitutes one of the essential properties of digital life.

Introducing the concept of PIO into our study allows us to hypothesize that recent learning environments can be considered as interacting social personal micro-worlds constructed in virtual space.

We propose developing Seymour Paper's Personalization and Virtualization approach, which one may call a Personal Identity Off-line by adding a Ubiquitous trend to the new Personal Identity On-line that we study in the context of the Ubiquitous Personal Learning Environment (Kojukhov & Levin, 2010; Graf & Kinshuk, 2008). In this context we study both the identity a user constructs by himself and the identity the user constructs through others (Amelung, 2007). The identity that a user constructs through another person comes from the information that is currently available. The forms of information, including on-line availability, the quality of work contributed, and replies in discussion forums significantly contribute to shaping and transforming his identity.

Another important point related to identity is that on-line identity is always present and accessible to others (Amelung, 2007). For any objects uploaded to the environment, or, for example, communications in collaborative tools, the information remains readily available and continues to influence the actions of others, even if the user is not currently on-line in the system.

3. PLE Research Goal

The main goal of our research is to study regularities and patterns in the process of designing social micro-worlds by students. We have observed a group of students from a teachers' training course.

The first hypothesis of our study is that a social micro-world can be considered as comprising a set of blocks interconnected according to some rules and corresponding to various channels (blogs, forums, cloud storage, events, content providers, etc.). These channels include Facebook, Wikipedia, YouTube, Dropbox, Evernote, etc. By connecting the above blocks, a student creates his/her unique personal social micro-world. The student achieves this by means of various web-software tools (for example, the so-called mash-ups), which are used to arrange the combined functioning of the above blocks.

Using multiple Social Media channels in a classroom environment can be both complicated and time consuming. Because the data are transient the teacher must check the environment often and respond to many students' requests. The data are always moving and the window of revision is relatively small. There is a service that allows one to achieve to some extent the automation of social media tools. It is quite a popular IFTTT (If-This-Then-That) mash-up that specifies a set of rules defining interactions between different social media channels. Some teachers found the service to be very useful. For example, their students create Twitter accounts and follow a teacher's id. This helps connect educational resources to twitter followers and establishes a foundation for creating a personal learning network (Curos, 2010) and allows a teacher to immediately give students feedback and "a pat on the back".

In our study, we used IFTTT whereby students form their set of rules when creating their social personal micro-world. Besides the obvious advantages of IFTTT described above, another reason for choosing the IFTTT mash-up is based on the authors' belief that IFTTT is a highly appropriate tool for reflecting on the recent network's uncertainty and unpredictability.

The second hypothesis of the study is the idea that the structure and content of the IFTTT rules contain information about epistemic and meta-cognitive characteristics of the students' behaviour in the network. Indeed, learning activities such as planning how to solve a given task, monitoring comprehension, evaluating progress toward completing a task, and knowledge of these activities are meta-cognitive in nature. Thus, an important step in enhancing the education environmental outcomes is to obtain clarity regarding how meta-cognition influences how and how often teachers bring themselves into the learning process and especially into the on-line learning environments (social communities, forums, etc.). Teachers' PIO is correlated with the content of their participation in online environments and in creating collective knowledge. It is therefore critical to design online interaction contexts to support PIO in a manner that promotes meta-cognition and development of soft-skills for constructing a community of collective knowledge rather than simply sharing experiences and individual insights (Johnson et al, 2010).

Studying both of the above hypotheses is reflected in a so-called Traffic Pattern, as well as in interviews, which clarify the students' epistemic beliefs about new learning within social personal micro-worlds.

4. Study of Teachers' Training Based on IFTTT

4.1 Research Methodology

A new course for teaching teachers within the social micro-worlds is being developed in the School of Education at Tel-Aviv University. This course includes a number of essential theoretical topics that allow teachers to better understand the new social and technological trends in education, as described above. There are a number of practical exercises within the agenda of the course, allowing teachers to explore those tools that will be used in communicating with the teachers' community as well as for creating and customizing their personal micro-worlds. For instance, the teachers' personal learning network includes social communities, forums, and digital curation networks. The study includes developing a curriculum for teachers' training by using a specific social micro-worlds environment. During the training, we study meta-cognitive aspects of teachers' interaction with the environment and the inter-connection between meta-cognitive and epistemological aspects of this interaction.

Population studied. A group of 20 teachers took part in the course and participated in the study. The course lasted half a year (1 semester). Teachers were required to have only a basic understanding of using computer technology in their classes, such as the ability to use Power Point software for preparing teaching material and having only basic Internet skills. There were no limitations regarding the professional background of the participants. The participating teachers were requested to plan and develop an IFTTT environment in their classes, adapting it when necessary.

Questionnaire. The research included an initial epistemological questionnaire where the teachers were asked about their epistemic beliefs regarding using educational computer technology in their classes. The questionnaire uses the life experiences of the teachers in order to better understand how teachers use technology in their classes, as well as why they decide to use technology in specific ways (values, beliefs, targeting specific needs, etc.) as described in (Wang & Chai, 2010).

IFTTT-based environment. IFTTT mesh-up software supports teachers in creating their personal social micro-world, which enables them to manage a number of channels for curation of subject content, to retrieve educational data, gather and process it as well as keep it for future use. In addition, IFTTT was used for managing student-teacher and student-student interactions.

Teachers create "recipes" expressing different if-this-than-that actions over two or more channels (curation tools, social networks, web apps, subject-oriented software and even hardware). The recipes define the set of rules that are supposed to be used to perform a specific action within one of the channels when something happens on the other one. IFTTT follows the "if this happens, then that occurs" process.

For instance:

- For managing a Facebook group, all posts with a specific "tag" are captured in the Google Doc
- Tweeting with a certain hashtag on Twitter will send that Tweet to a Google Doc
- When you curate a specific educational topic in "Scoop-it" all new topics that you curate are sent as posts in a Facebook group as RSS feed
- Send certain Wikipedia-related RSS feed updates to Evernote, etc.

Teachers were requested to create 4-8 recipes as a combination of the channels summarized in the table below.

Table 1: IFTTT Channels

IFTTT Channels			
Events/Triggers Notifications	Blogs/Forums	Storage	Content providers
E-mail Facebook states/wall/Group posts Feeds/News feed/RSS Google News	Facebook Groups Blog Google+	Google Drive Evernote Dropbox Feedly	Wikipedia Vimeo YouTube Camera Any News forums

Facebook Group. Teachers (students of the course) were requested to join the dedicated Facebook group and reflect on their findings and progress in developing the environment. The FB group was also used for sharing teachers' questions and discussing the best applicable recipes. The FB posts and IFTTT recipes were connected with the tool collecting data about teachers' on-line interactions with the content as well as during their on-line discussions in the group and in external forums. In this context, we studied both parts of the teacher's Personal Identity Online: the identity that a teacher constructs by himself and the identity that the teacher constructs from others (Amelung, 2007). In the Environment the identity that a teacher constructs from others comes from the available information. The forms of information, including on-line availability, the quality of the work contributed, and replies in discussion forums, significantly contribute to shaping the identity. The collected data are analysed in conjunction with the data collected from the questionnaires.

Analysed data. The tools were developed to analyse teachers' traffic patterns and to estimate the following data.

The relationship between teachers' PIO and use of the environment regarding the following criteria:

- The number of attempts to access Wikipedia to retrieve education content
- Curation of the topic
- Use of other data retrieval engines like Google, Yahoo, and other forums
- The number of attempts to access Wikipedia to bring arguments to discussion
- Students' Success/number of citations in the forum versus the frequency of Wikipedia browsing

The meta-cognitive characteristics are:

- Correlation between finding a truth and curating authorities
- Better start with something and reach an initial agreement
- Truth to be achieved later (soft skills – leadership, compromises, etc.)

The following PIO characteristics are considered in this research:

- How others view this person: authority, citations
- How frequently this person is involved in the discussions
- Whether this person finds applicable key terms that are frequently used by other participants in the discussion
- The role of the person in creating group knowledge

The participants' discussions (Nodes) and those who accessed external content providers (e.g. Wikipedia) were graphically represented using the NodeXL application.

4.2 Analysis and Evaluation of the Results

The evaluation encompasses meta-cognition analysis in order to assess the level of meta-cognition of teachers' interactions with the environment, as proposed in (Topku & Ubiz, 2008).

The discussion forum is one of the tools used for evaluating teachers' meta-cognition. Each message from teachers in the forum discussions is assessed regarding the interaction types of coding techniques developed by McKinnon (2000). A grading rubric developed by Topku & Ubiz (2008) is used to score the teachers' messages, thereby determining the quality of their participation; it covers all components of meta-cognition: meta-cognitive knowledge, meta-cognitive judgments and monitoring, as well as self-regulation and control of cognition.

The correlations between the various aspects of teachers' beliefs and their on-line interactions are studied by using the method described in (Wang & Chai, 2010).

The preliminary results imply that instructors should encourage teachers to promote their Personal Identity On-line by sending messages explaining or clarifying concepts by using examples from their education practices. Using keywords or tags in the context of IFTTT is highly appropriate for this purpose. These messages usually contained high levels of interactions, motivating teachers to control and evaluate in their minds their knowledge structure as it is related to concepts under discussion. This fosters high-level meta-cognition and stimulates students' awareness of knowledge of the task and self. It also relates the course content to prior knowledge and experience, as well as makes inferences.

In measuring the correlation between the presence of Personal Identity On-line in the discussions and the high level of meta-cognition, the following findings were reported:

On-line discussions with participants whose Personal Identity relies on trustful personal experience, based on educational practice, are usually associated with more follow-up participation in discussions, implying a higher rate of meta-cognition in the overall discussion.

Another finding, also suggested in (Ke et al, 2011), is that in order to promote meaningful on-line discussions, it is critical to promote the creation of social community-based identity. This idea links identity presence with collaborative knowledge, whereby on-line students not only express their personal identities—they also construct a joint social identity in order to achieve collaborative knowledge building.

5. Conclusion

The recent progress of modern society is linked to the rapid growth of various means of communication and, as a result, with unprecedented socialization. Under these circumstances, Papert's concept of private micro-worlds is updated by adding a social dimension. Introducing the social dimension into the concept of personal micro-worlds enriches the constructionist approach, which, in turn, engenders a new concept in the personal learning environment. Thus, the personal micro-world is transformed into the so-called social personal micro-world of a networked person. The research results indicate that the social micro-world can be considered as comprising a set of blocks interconnected according to some rules and that it corresponds to various channels (blogs, forums, cloud storage, events, content providers, etc.).

We proposed using a popular mash-up IFTTT (If-This-Then-That) that specifies a set of rules. The students form the set of rules by creating their social personal micro-world. We showed that the structure and the content of the IFTTT rules contain information about the networked students' behaviour, both in general, and the students' Personal Identity On-line, in particular.

By analysing the Traffic Pattern and conducting interviews, we clarified the students' epistemic beliefs about new learning within social personal micro-worlds and the meta-cognitive aspects of this learning.

To the best of our knowledge, social learning environments were never studied before from the constructionist point of view. Our research fills this vacuum. The research results shed light on social learning environments, both as students' micro-worlds and as teachers' personal knowledge management tools.

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