

Networked Learning Based on Digital Curation

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Abstract : Social Digital Curation (SDC) is one of the most innovative types of Social Media. SDC is a process of creating ontology of a specific subject by selecting digital content suitable to the subject. The SDC utilizes web collaboration between participants of similar subject oriented communities. In order to define the subject, each of the SDC participants (curators) formulates a relevant set of keywords. A specific curation tool forms an input stream comprising a number of records having various levels of relevance and quality. 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 the personal curriculum. One of the most important features of the above process is the fact that the curation takes place in a form of collaboration with other curators of similar subjects. Current output streams of some curators may, in turn, form input streams of others. In this case, the conventional learning turns into a form of intensive collaborative learning action in which the curators participate, and which is the focus of our study. The network reality today requires concern for the proper and secure use of web information. The SDC provides students with a collaborative learning environment, which is refined by them. Advanced participants of the SDC network, that have high reputation, teach novices in their own style, while novices are being motivated to upgrade their reputation and to become successful learners and then teachers to other participants. The criterion of success of a person's SDC is twofold. It can be assessed individually by each of the participants, by evaluating the quality of that student's curation output stream. On the other hand, it can be assessed collectively when evaluating the student's reputation achieved during the curation. Besides creation of their personal curriculum, the curating students develop their digital literacy skills. One of such skills is so-called 'network awareness'. The SDC environment, being a dynamic and unpredictably transforming one, requires the user's ability to act correctly in unexpected situations, and helps to develop their network awareness. In our study, we observe a group of curators, which comprises both graduate students and faculty members. A popular curation tool, which is used in our study, is Scoop.it. The research combines both observing the curators' behavior in the network, and conducting individual interviews with the participants. Besides the qualitative research, we use computer simulation as a methodological tool for our study. We construct models of hypothesized curators' behaviors, and test them by running the corresponding simulations. Moreover, we assume that the SDC simulation can be used as a powerful learning activity to reveal a participant's metacognitive ability. We use the hybrid simulation software AnyLogic in our project. Using the hybrid simulation is innovative in the educational research. In our study, we test both the scientific, and the educational potential of the hybrid simulation for studying behavior of the digital curator.

Keywords: digital curation, social computing, hybrid simulation, web learning environment, collaborative learning.

"Getting information off the Internet is like taking a drink from a fire hydrant"

Mitchell Kapor

1. Social Digital Curation

This above epigraph refers to the challenge presented to us not only of the high quantity of information, but also of the quality of the information available today. Today, Web content includes a lot of incorrect information, mistakes, mistruths and information from non-authorized sources. The abundance of information, which creates valuable data and advanced information experts, is unfortunately also associated with misinformation, misleading and non-quality information. Because of the vast amounts of information available today on the web, we are required to teach students the skills of finding appropriate information and the proper use of this information (Hsiao et al. 2013).

If the above mentioned regarding the abundance of information would have appeared a numbers of years ago before the digital era, the only way to overcome with it would have been by hierarchical structure of categorization and sorting. In our work, we study an innovative approach for overcoming abundance of information that is called Social Digital Curation (SDC).

The curation comprises selection, preservation, maintenance, collection and archiving of digital assets. Curation is a specific activity, in which the participants receive an input stream of data, generated in accordance with a predefined set of keywords (tags), that each of the SDC participants (curators) formulates in order to define the subject. A specific curation tool forms an input stream comprising of a number of records,

which have various levels of relevance and quality. The task of each curator is to filter the input stream by approving some records and rejecting others. As a result, every curator forms his/her own output stream that we consider to be the personal curriculum. One of the most important features of the above process is the fact that the curation takes place in a form of collaboration with other curators of similar subjects. Current output streams of some curators may, in turn, form input streams of others.

Social Digital Curation is an innovative type of Social Media. It can be considered as a process of creating ontology of a specific subject by selecting digital content suitable to the subject. The process of selection and creation that is done in accordance to the curator's understanding, and in the way he/she perceives the subject is what we refer to as ontology. The SDC utilizes web collaboration between participants of similar subject oriented communities. It is a process that combines personalization and socialization whose essence is creating knowledge by selecting, arranging, combining and collecting digital content based on cooperation between participants. SDC is a content creation process with unique cultural and social characteristics. It deals with several trends: the rapid growth of information, the necessity to be able to find information and use it in a meaningful context (Rosenbaum 2011) and the utilization of prodigious potential of the emerging social networking process. Instead of one evaluator and processor of the knowledge, there is a network of trusted peers, supported by technology (Siemens 2006). The curator's role is to use content created by others in a digital network sources to create a high-quality and significant knowledge. Mihailidis & Cohen (2013) discussed three ideas of which SDC supports: 1. SDC is a new form of organizing knowledge. 2. SDC as value added – knowledge available any time and anywhere, distributed in different ways and from different sources. 3. SDC as digital and media literacy - SDC is an activity of solving problems, developing responsibility, analysis, evaluation and creation (Mihailidis & Cohen 2013).

In our research, we deal with using SDC as educational means. Specifically, we consider SDC to be a specific learning activity in schools in the digital society.

2. Educational Digital Curation

Educational digital Curation (EDC) is associated with utilizing the digital curation in the educational process. It includes introducing curation into learning, teaching, curriculum development and learning environments.

Future curriculum is a personal curriculum and is not a general curriculum tailored from above (Goldin 2009). According to our hypothesis, the output curation stream can be considered a form of the personal curriculum of the curated subject. This hypothesis is based on the understanding of the curation process as a personal action, which includes the selection, and categorization of different content fragments belonging to the subject. Additionally, in contrast with conventional learning, the curation is a form of a collaborative learning activity. The curation, as the learning activity, is the focus of our study.

The recent networked reality requires significant information security awareness. We hypothesize that the SDC is a powerful network awareness education activity. The curation, being a dynamic and unpredictably transforming activity, requires the user's ability to act correctly in unexpected situations, which is, actually, the network awareness. The SDC provides a unique collaborative learning environment, constructed by students themselves, on the one hand, together with the support system of their collaboration on the other.

During the curation process, novices learn from advanced participants (with high reputation levels). The novices are motivated to upgrade their reputation since it is considered as an "objective criterion" of the quality of their learning process.

Notice that the criterion of success of the educational curation is twofold. On the one hand, the teacher can assess it by evaluating the quality of the curation output stream. On the other hand, it can be assessed collectively by other curation participants in the form of the student's reputation achieved during the curation.

In general, curation (not especially digital) is a well-known human activity known since ancient times. The innovation of our study is in: a) the use of digital curation. b) the use of curation for educational purposes.

First of all, our study of the EDC is based on the investigation of curators' behavior patterns. Additionally, we study social characteristics of curation to verify our hypothesis about the curation as a powerful learning

activity at the new school. The research combines both observing the curators behavior in the network, and conducting individual interviews with the participants.

Besides the qualitative research, we use computer simulation as a methodological tool of our study. We construct models of hypothesized curators' behaviors, and test them by running corresponding computer simulations. Moreover, we hypothesize that the SDC simulation can be used as a powerful learning activity to reveal a participant's metacognitive ability.

We use the hybrid simulation software AnyLogic in our study. The using of the hybrid simulation has two goals. On the one hand, the hybrid simulation of the SDC allows studying the curation process and its regularities. On the other hand, it allows to study constructing the hybrid simulations as a specific innovative learning activity.

3. Methodology

3.1 Curation Software

In our study, we observe a group of curators, which comprises both graduate students and advanced curator (inter alia faculty members). A popular curation tool, which is used in our study, is Scoop.it (<http://www.scoop.it>) (see Figure 1). The Fig. 1 presents a scoop.it screen corresponding to the curation of a specific topic "Education and Cultural Change" (curated by Pierre Levy) including the personalization and socialization activity that has taken place on the topic shown. For example on the right hand corner the 13.5k views | +3 today can be opened to access further information regarding the socialization activity. The icon 'Suggest' reveals the stream of data that was received as a result of the keywords that were chosen by the curator. The symbol of the medal on the upper left hand side represents the level of reputation.

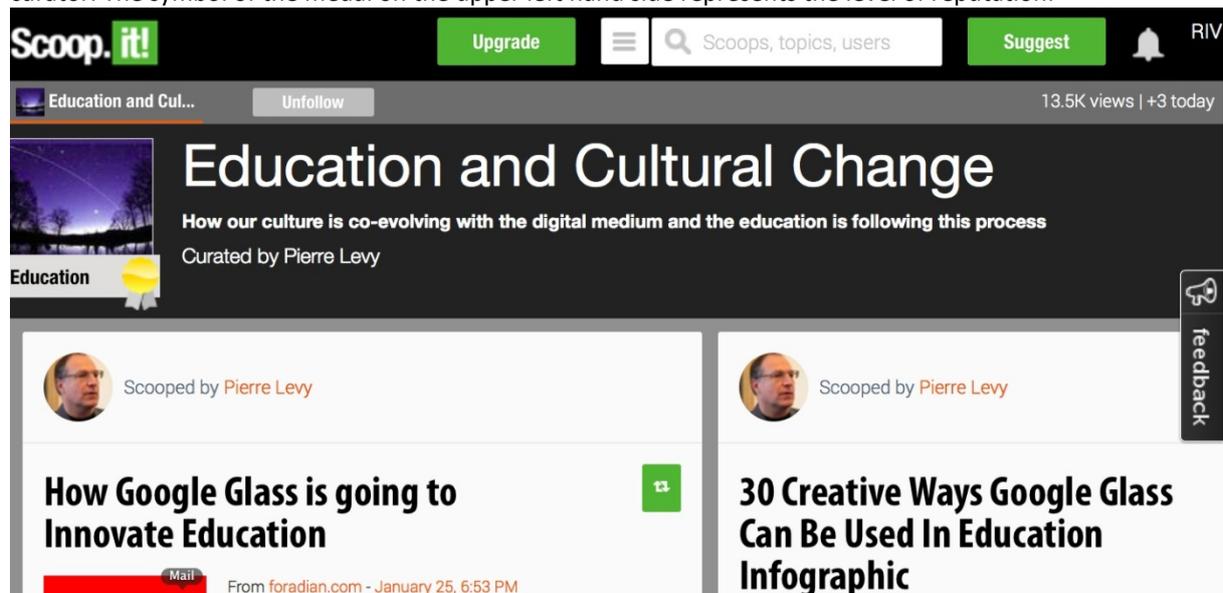


Figure 1. Scoop.it

Scoop.it is a social platform for choosing relevant content, combining it and publishing it after personal analysis and commenting. It generates a curation stream according to a set of keywords that is defined by the curators and proposes a diversity of information sources that is managed by them. The curators can also add contents, which are personally selected from other sources, and content that is published by other curators of similar subjects. It is a social media platform in which curators follow each other and react to their partners' scoops.

3.2 Hybrid Computer Simulation Tool

The simulation tool we use for the research is AnyLogic, which is a hybrid simulation software combining three simulation approaches: agent-based simulation, system dynamics simulation and discrete event simulation.

3.2.1 System Dynamics Simulation

System Dynamics (SD) is a field of study, which has the unique ability to understand, and to simulate real-world dynamic systems (social, economics, etc.). The SD methodology allows overcoming the complexity of the physical and social structure of these systems. It is a methodology that defines a problem and its solution by mathematical and logical analysis of cause and effect, behavior over time and feedback loops. Originally, the systems dynamics research was engaged in control theory and modern theory of dynamics of non-linear field of mathematics and natural sciences. It then extended to the areas of social sciences, industry, business, agriculture and geography. In recent years it has began to appear in the field of education. The simulation interprets the world by a differential equation in order to understand the dynamic behavior of the system, evaluate and improve it. The levels of the complexity of the process of taking bits of information from the world and turning them into a consistent and coherent theory can vary from trivial to the most challenging. The strong point of the concept of dynamic systems is that it provides a mutual connection between mental models and computer simulations, expanding by this the boundaries of our mental models as people and look holistically at the phenomena (Forrester 1994; Nuhoglu & Nuhoglu 2007).

3.2.2 Agent Based Modeling

Agent Based Modeling (ABM) is a kind of the computer simulation that determines dynamics by defining individual behaviors of each of the participating agents. The objective of ABM is to provide information about the system to be simulated, through analysis of situations being result of the agents' interaction. The ABM is a decentralized simulation approach, which describes the system from the perspective of the individuals constituting the system, rather than at the aggregate level of the system. The ABM modeling comprises: identifying the agents, defining their behaviors and running the simulation. The ABM model describes behaviors of each agent separately and the interaction between them. The ABM is able to illustrate how interactions between individuals can produce different phenomena: social patterns, norms, and other collective actions. It provides justification of such significant idea as the fact that the system is much more than just a sum of its parts (Macy & Willer 2002). The benefits of ABM are its ability to identify phenomena, provide a description and natural imaging of the system and adapt itself to the changes taking place in the system (Bonabeau 2002). A number of significant ABM models in different fields are known: industrial systems management, logistic networks, human resources, customers and suppliers, transportation and a variety of social systems.

3.2.3 Discrete Event Simulation

Discrete event simulation (DE) (Borshchev & Filippov 2004) is a simulation approach, having its roots is GPSS approach (Gordon 1961). According to this approach, there is a sequence of events that are organized around a discrete time. The occurrence of one event causes in response later events to be scheduled in the queue, according to a behavior rules described by a flowchart. The DE contains a number of so-called passive objects (entities). The entities (i.e. data records, in our study) don't have their own behaviors. It can be programmed to react according to rules, described by the flowchart's blocks. A discrete clock defines a scheduling of the DE. The clock is turned on if something significant happens in the model, i.e. when an entity begins or finishes its action. A model queue is used to store the list of waiting events. The simulation ends when the queue is empty.

3.2.4 Hybrid Simulation

Hybrid simulation integrates the three above simulation approaches. By combining different simulation methods, the hybrid approach enables to describe complex dynamic system taking advantages from each of the pure approaches. In hybrid models, the DE approach usually provides the top level of system simulation. It models the system updating according to the changes happened within the model. It allows considering the process from the objects' point of view. Alternatively, the ABM simulation enables to study the behavior of entities by programming them using state diagrams (Harel 1987). The SD simulation is usually used to model the linear behavior of the system's components.

In our project, the implementation of the computer model is performed by using the hybrid simulation software AnyLogic. AnyLogic comprises all the above types of simulation and provides their integration in order to create the as accurate as possible model of the system..

3.3 Participants

Our research was divided into two stages. The participants of our preliminary study were graduate students (n=35) of Science, Mathematics and Technology Education, each participating in a research seminar. The participants of the next stage of the study are graduate and undergraduate students (n=80) and advanced curators (n=5).

3.4 Instruments and Procedure

As mentioned above, the participants use Scoop.it as a curation tool.

The students had to select, collect, tag, comment and share materials enriching a topic chosen by them. Each student was requested to choose a topic for his research and to curate his topic so as to build his personal curriculum on the topic. The students received specific instructions about what they had to do during their curation activity. They had to curate the content from the curation stream generated by Scoop.it, from other Internet sources they found by themselves and from academic journals.

The students received instructions about the curation in general and about using the Scoop.it in particular. We told them how to create an account, how to create a topic, curate and maintain the topic. The students could choose whether they wanted to identify themselves by using their real names, or just by using a nickname. The students also received instructions about what they were instructed to do while curating, such as: to diversify their resources, to use academic resources in addition to other ones, to write *their* point of view while curating any item, to tag it, to use social tools to share knowledge with others.

During the semester we held discussions in classes about the topics' content and about the procedure. At the end of the curation project, the students had to summarize their curation experience in the form of a written report, which actually presents the sum and the analysis of the personal curriculum on the selected topic.

3.5 Method

There are three phenomena that, according to our hypothesis, have to be expressed in the curation process: Personal Identity Online (PIO), Data Intensive Science (DIS) and Social Media (SM). The analysis of the participants' curation activity was divided into three domains corresponding to the three aforementioned phenomena. We have defined a number of the main activities connected to the curation process. According to the mentioned above, we developed a conceptual framework to describe in a schematic way the EDC process, map the relationships between the operations that performed in the learning process and the trends we mentioned above: PIO, SM, DIS and to present factors affecting learner activities and products (see Figure 2).

The study consists of three stages. At the first stage, we followed the participants' curation actions and analyzed their work according to the study variables as detailed in the conceptual framework mentioned above. We collect their usage data, using software developed for this purpose. This software collects data of all the participants. We intended to find out which of the parameters are most important and how we can classify the students in accordance to their curation activities. In order to analyze the curation outputs we defined criteria for a qualitative curation output. The assessment of curation outputs is done in accordance with the criteria defined. In order to validate the data, the quality of curation outputs shall be considered by another judge.

The second stage of the study includes observations of the students' discussions in class and of the written report regarding the curation activity, in order to analyze the students' beliefs about the curation process and about the change that occurred in their attitudes during their curation activity. We also conducted in-depth interviews with some of the advanced curators that were participants in our study and analyzed their activities and beliefs.

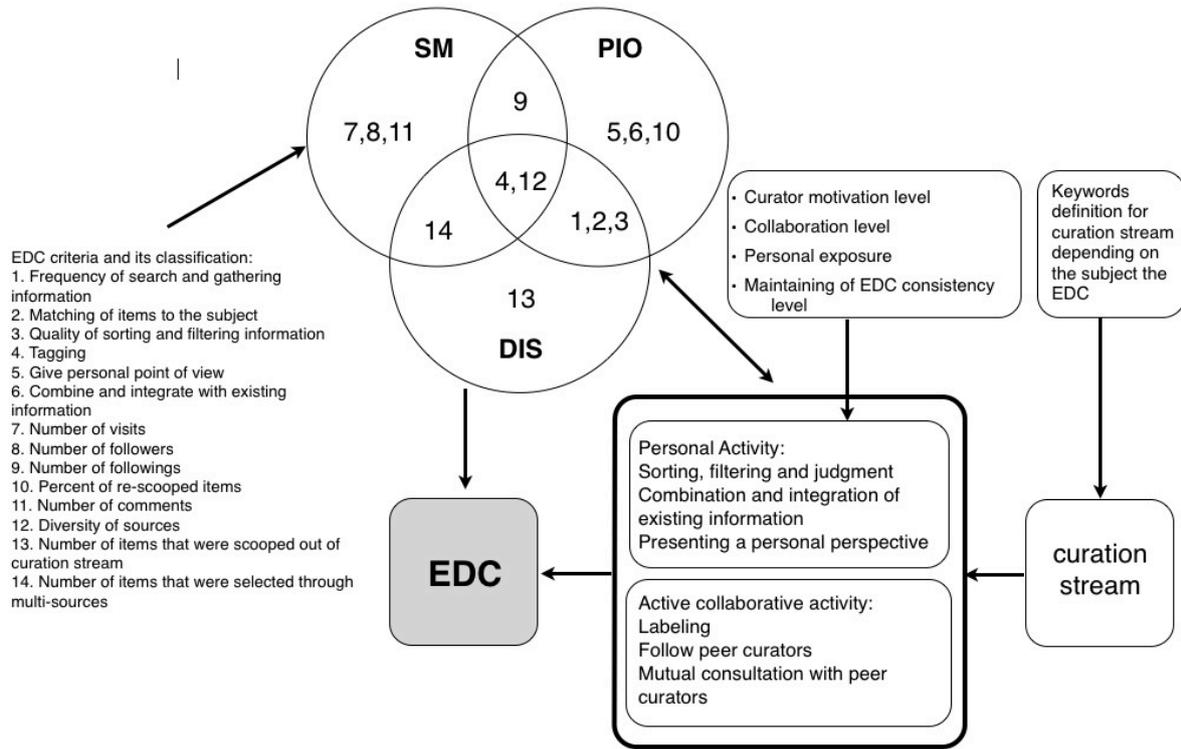


Figure 2. Conceptual framework of the study

At the third stage of the study we create a computer simulation of the EDC by using the hybrid simulation software AnyLogic. In this paper, we describe the current state of the developed model. In our model, the DE describes the sequence of the events. The system entities of the DE are both data records and curators. The system events are several of actions, such as: publishing the data record, deleting them etc. The system states of the model, which are driven by these events, correspond to the amount of records in the curation stream. The curator decisions are described by a flowchart. The ABM is used to describe the behavior both of the curators and of the data records. Each curator as well as a record is simulated as agents. The curator agent behaves according to the specific flowchart (Figure 3). Each *record* is also simulated as a specific agent programmed as a state-chart. In the combination DE - ABS simulation, the DE models the system's top-level while the ABS models the bottom level.

In our project, the SD simulation corresponds to the curation streams simulation. There are three kinds of streams and each of them can be considered as a stock. The flows are controlled by the state diagram (see Figure 4).

3.6 Discussion

Social computing provides tools that enrich the learning process. It expands the process of collaborative learning and emphasizes the mutuality between the construction process of each student and the cooperation and social relations created in the learning community. The learning community may consist of participating people who are far away in space and time.

Many researchers have found that the students we teach today are so-called "digital natives"; they have different patterns of work and different learning preferences than older students have, that students of this generation have social motivation for learning, they want to impress each other and join forces to help the group tasks, therefore the combination of social networking and education is necessary (Popescu & Cioiu 2011; Wheeler 2009). Preliminary examination of our findings indicated that the contribution of socialization increased the quality of products more than the contribution of diversification of the resources. In addition, there is proportionality between the level of personal activity of students - that is the level of the contribution of their personality to the process - and their social sharing. Although this is a preliminary research, it is possible to estimate from the findings, that the greatest importance in terms of the contribution to the quality

of the curation process is the use of social media tools and the internal desire/motivation of the curator to acquire knowledge through the process. The goal of the successful students was to learn from self-motivation and to try sharing their infosphere among their community of knowledge in order to improve their learning

The concept of EDC is a new concept as such it describes the educational process and is also an intellectual phenomenon that contributes to the creation of knowledge, intelligence and new skills. This technological, social and educational innovative phenomenon is associated with social and cultural phenomena surrounding us in recent years, and affects our way of life and our children's education. Yet, EDC is not prevalent as a formal educational process and research. In this study we are investigating this innovative phenomenon from theoretical perspective. The hybrid simulation of the curation process was build for this purpose.

According to our hypothesis, the hybrid simulation can be used not only as a research tool but also as a learning activity. As research tool, it is used in order to analyze the curator's behavior. As a result we plan to realize whether the curation is a superficial learning activity or whether there was deep and meaningful learning. In turn, creating the hybrid model of the curation process is a metacognitive learning activity, which requires the self-reflection from the student. Such kind of activity looks very promising as a complementary part of the educational curation.

Preliminary results of our study allow concluding that SDC has of great importance as a perspective educational activity. The use of a hybrid simulation both as a research and as a metacognitive means, significantly increase the educational potential of the curation.

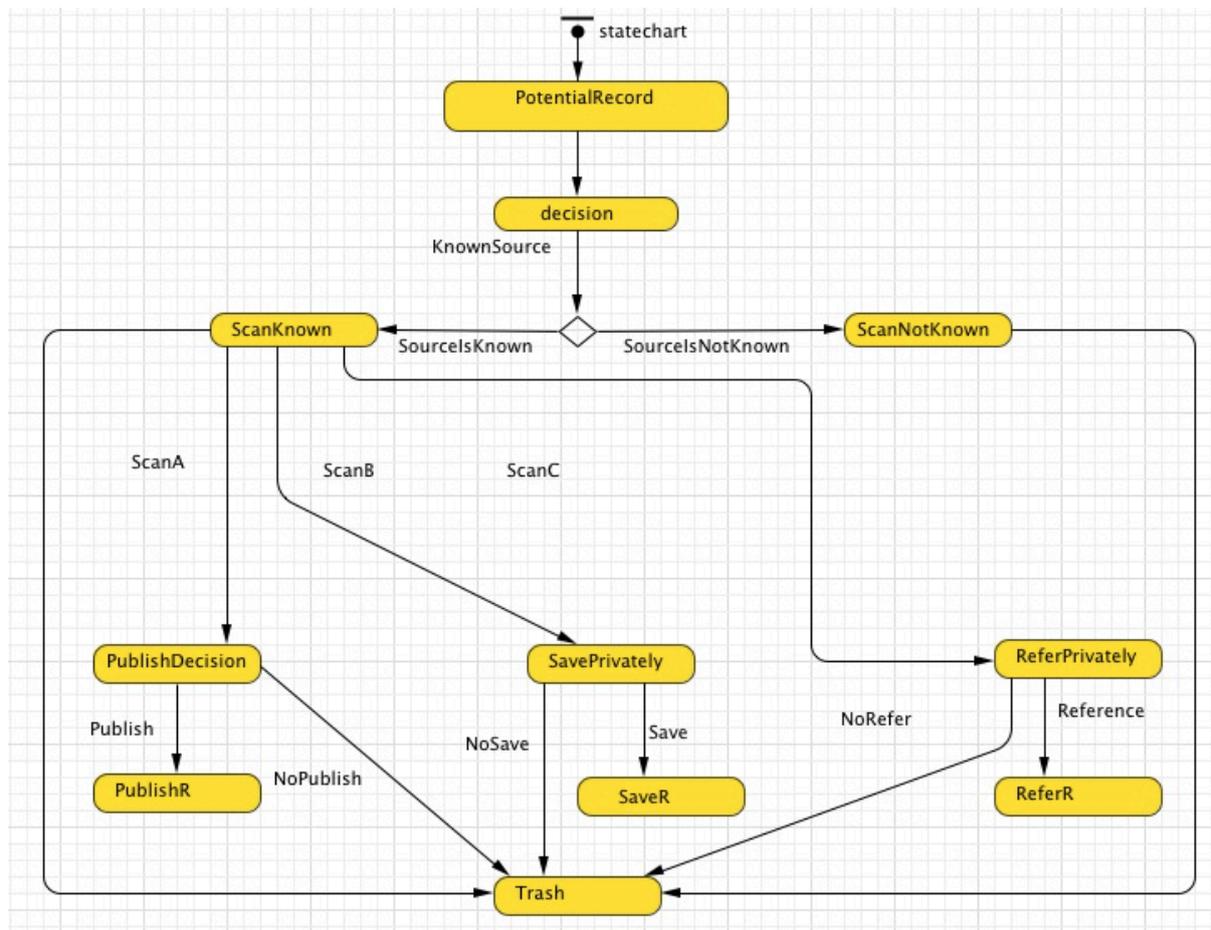


Figure 3. Flow Chart Curator Behavior

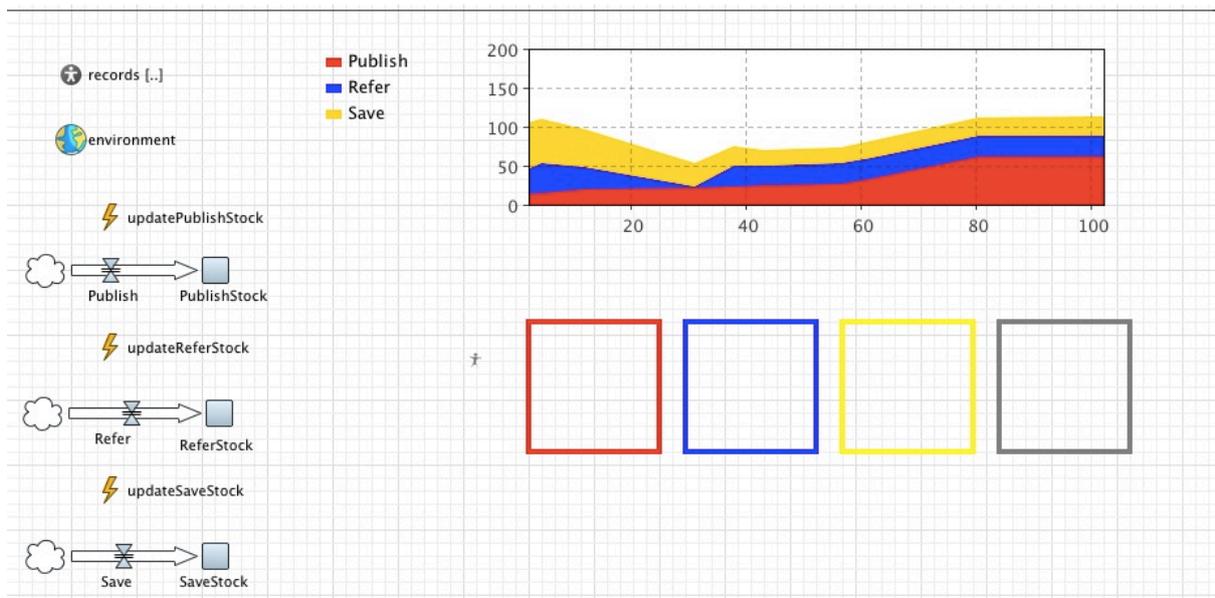


Figure 4. Curation Stream Stock and Flows

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