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STUDYING 3D PRINTING TECHNOLOGIES IN THE CONTEXT OF DEVELOPING INFORMATION LITERACY AMONG PROSPECTIVE SOCIAL WORKERS

У статті досліджено питання запровадження технологій 3D-друку у процес професійної підготовки майбутніх соціальних працівників у закладах вищої освіти. Констатовано, що 3D-друк може стати важливим інструментом у професійній діяльності соціальних працівників. Використання таких технологій дозволить підвищити оперативність та індивідуалізацію створення предметів широкого спектру призначення для забезпечення потреб споживачів соціальних послуг. Акцентовано увагу на тому, що предмети, які можуть бути виготовлені за технологією 3D-друку у процесі діяльності соціального працівника, ні в якому разі не спрямовані на заміну професійних медичних або інженерних рішень, а слугують тільки допоміжними елементами для полегшення виконання елементарних дій у повсякденному побуті.

Для практичного використання студентами запропоновано класифікацію предметів для споживачів соціальних послуг за їх призначенням. Визначено такі категорії: фіксатори, тримачі та підставки; органайзери та контейнери; адаптери для полегшення використання предметів людьми з обмеженими функціональними можливостями; елементи підвищення безпеки; тактильно-інформаційні та візуальні ідентифікатори; елементи психологічного розвантаження. Запропонована система класифікації виробів, які можуть бути виготовлені в процесі надання соціальних послуг майбутніми соціальними працівниками, у поєднанні з технологією 3D-друку Fused Deposition Modeling (FDM), стала підґрунтям побудови окремого модуля в межах дисципліни «Інформаційні технології в соціальній роботі».

Проведено експериментальне дослідження щодо формування у майбутніх соціальних працівників умінь використання 3D-друку під час вивчення ними зазначеної дисципліни. Практична складова реалізації модуля з вивчення технологій 3D-друку була реалізована у вигляді виконання лабораторних робіт студентами, які виконувались шляхом групової роботи. Проведене дослідження підтвердило доцільність вивчення технологій 3D-друку у процесі підготовки здобувачів спеціальності «Соціальна робота». З'ясовано, що вивчення технологій 3D-друку сприяє підвищенню мотивації студентів до оволодіння обраною спеціальністю, розвитку креативності й здатності до вирішення проблем у професійній діяльності.

***Ключові слова**: професійна підготовка, інформаційні технології, освітній процес, інформаційна компетентність, технології 3D-друку, соціальний працівник.*

Problem statement. At the current stage of social and technological development, information technologies have become of paramount importance in the field of social work. Social work professionals must possess a wide range of digital skills that enable them not only to carry out administrative tasks and facilitate communication, but also to use these skills to expand the range of social services and improve their quality, accessibility and personalisation.

One of the latest applications of information technologies in social work is the use of 3D printing. 3D printing has the potential to become not only a new technology but also an important tool in the professional practice of social workers. The use of such technologies will improve efficiency and enable the customisation of a wide range of items. By mastering 3D printing technologies, prospective social workers will be able to produce these items locally at the points of service provision. In the context of social services, this means the ability to respond quickly to an individual's needs and create assistive devices that help improve their independence, safety and quality of daily life.

Analysis of the latest research and publications. The "Digital Compass", published by the European Commission, sets out a roadmap for achieving a successful digital transformation. It is noted, however, that the involvement of all stakeholders – including the education sector – is of crucial importance: "Digitalisation can be a decisive factor in the realisation of rights and freedoms, enabling people to transcend geographical boundaries, social status or community groups, whilst also opening up new opportunities for learning, leisure, work, research and the pursuit of one's ambitions" [European Commission, 2021, p. 2]. As for the direct study and application of 3D printing technologies, this contributes to the modernisation and transformation of training for prospective specialists, as abstract concepts are translated into tangible experience. As practitioners note, these technologies are becoming an integral part of practical training, fostering creativity, critical thinking and the ability to solve real-world problems [3D-Druck im Bildungswesen, 2025]. Swiss researchers G. Lütolf and J. Mathez highlight the positive impact of 3D printing on the motivation of prospective professionals: "Anyone who uses a 3D printer eventually ends up with a physical object in their hands: a keyring or even a dream palace. The opportunity to turn one's own idea into a product is highly motivating for students" [Lütolf & Mathez, 2017, p. 2].

It is worth noting that researchers are considering the introduction of 3D printing and 3D modelling into the training of prospective specialists in various fields, including: specialists in the digital technology sector [Гевко et al., 2022], skilled workers [Гуменний, 2022], teachers of vocational training and technology [Фещук & Симонович, 2022], teachers of computer science [Мосіюк, 2018], prospective vocational training teachers [Маринченко & Васенок, 2022], students of technical and artistic specialties [Барановська & Барановський, 2024], and teachers [Пазюк, Нищак, & Звоздяк, 2024].

Although there are a number of academic studies on the subject, it is worth noting that the list of specialties does not include prospective social workers. It is therefore relevant to investigate the use of 3D printing technologies in the training of these professionals.

The purpose of the paper is to identify opportunities for studying 3D printing technologies as part of the training of prospective social workers, with a view to developing their information competence.

Methods. A range of methods was employed to achieve the set purpose. Using the analysis and synthesis method, a review of academic publications on the research topic was conducted. The possibilities of studying 3D printing technologies as part of the training of prospective social workers to develop their information competence were explored using the pedagogical experiment method. The generalisation method was used to draw conclusions from the study.

Presentation of the main research material. With a view to fostering specific aspects of information competence among prospective social workers, we have incorporated the study of 3D printing technologies into their curriculum. The practical application of the knowledge and skills acquired was achieved through the production of items that may be required by recipients of social services. At the same time, it was noted that the required items can be produced using an existing design, by taking advantage of the options available on relevant online platforms. On the other hand, designs for items can also be created independently, provided one has the

necessary skills and uses specialised software. The range of such items can be very diverse – from small household items to those that serve as tools for performing specific tasks or as components of certain devices or equipment. Examples of items that may need to be made in the course of providing social services include a mobile phone holder, a pill container, a bookstand, a glasses stand, and so on.

At the same time, during the training, it was consistently emphasised that items produced using 3D printing technology in the course of a social worker's duties are in no way intended to replace professional medical or engineering solutions, but serve solely as aids to facilitate the performance of basic tasks in everyday life. The 3D-printed items and equipment components discussed in our study, which could be offered to users of social services, do not fall within the category of products that must comply with specific requirements and standards and require certification. Of course, when discussing the manufacture of items intended for users of social services, it is essential to ensure that they meet safety standards for use and operation. This requires, at the very least, a separate review of the requirements for the materials used in the manufacture of such devices.

An important part of our research involved working with students to develop methods for searching for and selecting device models for their manufacture using 3D printers. To this end, at the initial stage, we familiarised the students with our proposed classification of devices for social service users, categorised according to their intended purpose. In particular, we identified the following categories:

– fasteners, holders and stands;
– organisers and containers;
– adapters to facilitate the use of objects by people with functional limitations;
– safety enhancement elements;
– tactile and visual identifiers;
– psychological relief elements.

In the "Fasteners, Holders and Stands" category, we have grouped together products designed to keep items securely in place whilst they are being used, stored or moved. In particular, this list includes stands and holders for books, gadgets, glasses and personal hygiene items; fastenings and fixings for orthopaedic aids.

Products classified under the "Organisers and Containers" category can provide a more organised, compact and structured way of storing small household items and medicines. In particular, these include pillboxes; organisers for scheduled medication intake; organisers for medicines of various types and packaging forms; containers for storing contact lenses, hearing aids and dentures; boxes for batteries and rechargeable batteries, etc.

The range of assistive devices designed to help people with disabilities use everyday objects includes a wide variety of products that enable them to carry out daily tasks with less strain and effort. Such devices include handgrips for pencils, pens, mobile phones, spoons and cups.

We have identified the "Safety Enhancement Elements" category to bring together items that serve a protective or preventative function in everyday situations. These may include protective corner and edge guards, bumpers, safety stops, and access barriers (for people with cognitive impairments and children).

Items that can also be produced using 3D printing technologies in the provision of social services include tactile information and visual identifiers. Examples include large raised lettering and warning and information signs; features designed to make objects easier to recognise; coloured and high-contrast covers for levers, buttons and switches on domestic appliances; and tactile identifiers.

We have included a whole range of items in the "Psychological Relief Elements" category, designed to shift one's focus, distract from negative thoughts and feelings, and stabilise one's emotional state by stimulating the various senses. Anti-stress toys, brainteasers and jigsaw puzzles, mini board games, massage accessories and sensory balls can be used for this purpose.

It is advisable to apply the aforementioned theoretical findings and develop students' skills in using 3D printing technologies as part of their study of core subjects within the Social Work degree programme. In particular, in our case, this was the course "Information Technology in Social Work', which was added to the curriculum with the aim of developing students' information

competence. The proposed classification system for products that can be manufactured by prospective social workers whilst providing social services, in conjunction with Fused Deposition Modelling (FDM) 3D printing technology, has formed the basis for the development of a separate module within this course.

Undoubtedly, such training requires a specialised laboratory, where workstations must not only be equipped with 3D printers and other necessary equipment for producing various objects, but must also comply with the safety requirements for such activities. The layout of a workstation in the "Digital Technologies in Social Work" laboratory is shown in Figure 1.

Fig. 1. *A workstation in the laboratory for researching 3D printing technologies*

The choice of FDM 3D printing technology for students to study as part of the course is due to a number of advantages over existing technologies such as Stereolithography (SLA) and Selective Laser Sintering (SLS). Specifically, these are:

– suitability for developing basic 3D printing skills. This is due to the accessibility of FDM technology, which involves relatively simple model preparation, straightforward print settings and the ability to visually monitor the step-by-step formation of the item.

– ability to create safe conditions for use in the educational process. Compared to other technologies that use photopolymer resins, powder materials and more complex processes, the safe use of FDM technology requires fewer special safety measures.

– ensuring a visual learning experience. The design of FDM printers and the nature of the printing process allow students to observe the entire manufacturing process, namely: the feeding of plastic to the printing head, its extrusion in a molten state, and the layer-by-layer formation of the item. In addition, it is possible to demonstrate the effect of parameters such as temperature, layer thickness and print speed on the quality and appearance of the product.

– high potential for practical training. FDM technology enables students to develop practical skills effectively, as it allows everyone to carry out a 3D printing operation. Learning efficiency can be improved by reprinting a model after adjusting the settings in the event of errors, and this does not entail significant costs.

– relatively low cost of equipment and consumables. FDM printers are several times cheaper than SLA printers and dozens of times cheaper than SLS printers. Consumables for FDM technology are also several times cheaper. This makes it possible to incorporate a practical component into the educational process.

The practical component of the module on 3D printing technologies took the form of laboratory work carried out by students in groups. During these laboratory sessions, the students independently searched for models to produce using 3D printing technology, drawing on the classification of categories of devices for social service users provided to them. Free online resources were used as a source of ready-made models, specifically recommended platforms such as Printables, Thingiverse and others, which host a variety of models for 3D printing. We specifically emphasised that the selected models must be used in compliance with copyright conditions.

It is important to note that the FDM-printed models were produced using PLA, a biodegradable and bioactive thermoplastic derived from renewable resources. The raw materials used in its manufacture include corn starch, cassava root, and sugar cane and so on. Unlike materials derived from petroleum products, which are used to manufacture other types of plastic, PLA is a safe and environmentally friendly material that is virtually odourless. Furthermore, the melting point of this type of plastic is relatively low, ranging from 180 to 220°C. It is precisely these characteristics that make it the most suitable choice for implementing 3D printing technologies in educational institutions. Furthermore, PLA plastic offers the widest range of colours of any 3D printing material. This is particularly important when printing items for visually impaired or partially sighted people, for whom choosing the right colour (bright or, conversely, muted) is crucial.

The group of students' laboratory work resulted in a whole range of products, which were produced in accordance with the categories they had previously selected. For example, the group that chose the category of "Fasteners, Holders and Stands" produced various types of stands: for a phone (Fig. 2), for a book (Fig. 3) and for glasses (Fig. 4).

Fig. 2. *A mobile phone stand produced using 3D printing technology*

Fig. 3. *A bookstand produced using 3D printing technology*

Fig. 4. *A glasses stand produced using 3D printing technology*

The team working on the “Organisers and Containers” category presented the results of their work in the form of organisers for medicines and for taking tablets at scheduled times (Fig. 5).

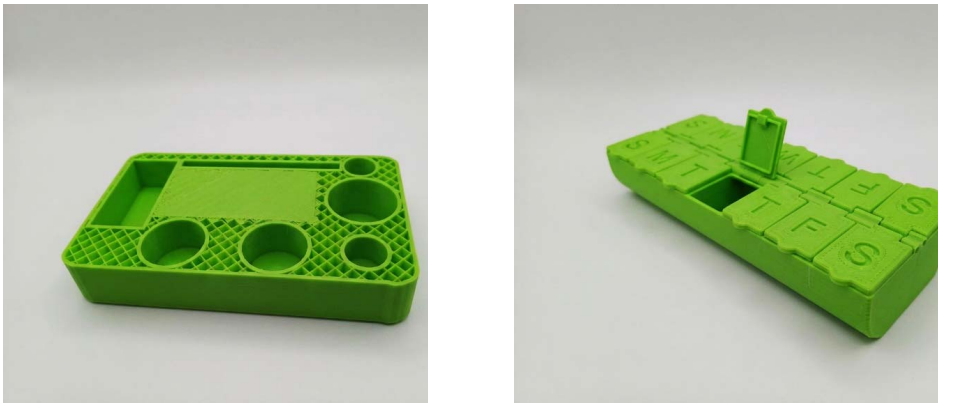

Fig. 5. *Organisers for medicines and for taking tablets at scheduled times, manufactured using 3D printing technology*

The group, which focused on items in the category “Adapters to facilitate the use of objects by people with functional limitations”, chose to make a pencil grip (Fig. 6).

Fig. 6. *A pencil grip adapter produced using 3D printing technology*

One of the groups focused on selecting models and products from the “Psychological Relief Elements” category, designed to provide psychological support, psychological relief and stress management. As mentioned earlier, the platforms where such models are concentrated offer a wide range of products of this type. Students were able to review this list for themselves and choose, at their discretion, a model that could be proposed specifically for this purpose. One such model, which was produced on a 3D printer, was an anti-stress toy in the form of a pyramid, used for calming, distraction and relaxation (Fig. 7).

Students’ practical use of this product has confirmed its effectiveness and its ability to evoke positive emotions in those who use it.

Fig. 7. *An anti-stress toy produced using 3D printing technology*

The photos above show just a selection of the items produced by the students as part of their laboratory work.

The study of 3D printing technologies has contributed to the development of information literacy among prospective social workers, as illustrated by the diagram (Fig. 8), based on a survey of students, specifically the distribution of responses to the question: “Do you consider the knowledge and skills acquired in 3D printing to be useful as a component of information literacy for your future professional activity?”

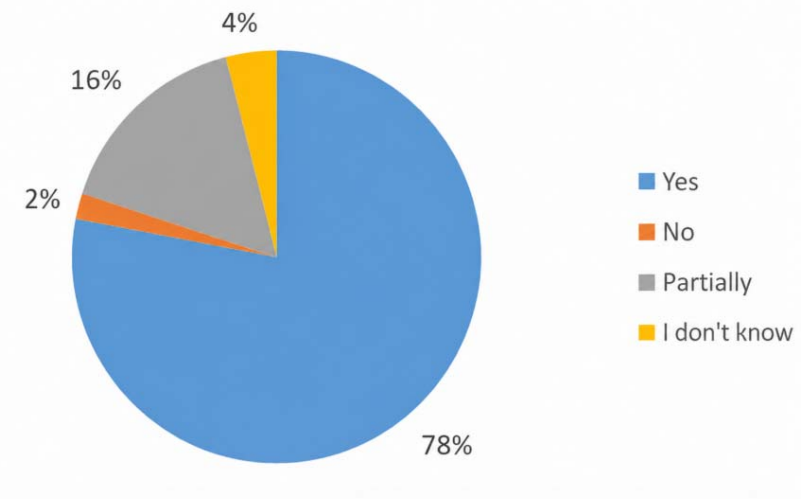

Fig. 8. *Diagram showing the results of the student survey*

As can be seen, the results presented in the diagram clearly demonstrate the positive impact of the proposed module on 3D printing technologies – within the “Information Technology in Social Work” course – on the development of information literacy among prospective social workers.

Conclusions. The study has demonstrated the value of integrating 3D printing technologies into the training of students specialising in Social Work. This can be achieved by introducing a dedicated module. Studying 3D printing technologies helps to boost students' motivation to master their chosen specialty, and to develop their creativity and problem-solving skills in their professional practice. Mastering 3D printing skills will enable prospective social workers to meet the specific individual needs of users by creating appropriate items. Based on the intended use of items for social service users, we have proposed the following classification, identifying the following categories: fasteners, holders and stands; organisers and containers; adapters to facilitate the use of items by people with functional limitations; safety enhancement elements; tactile and visual identifiers; and psychological relief elements. Group work on selecting and producing items for social service users using 3D printing technology took place through student collaboration, helping to develop teamwork and communication skills. Feedback from students confirmed the value of the knowledge and skills they had acquired in 3D printing for their future careers.

Further research could focus on developing the academic and methodological aspects of studying 3D printing technologies as part of the training of prospective social workers.

Adherence to Ethical Standards. The study complies with the ethical standards of the Declaration of Helsinki of 1964 and its subsequent amendments. The study was reviewed and approved by the Academic Council of the Faculty of Humanities and Pedagogy of the National University of Life and Environmental Sciences of Ukraine, Kyiv. Each student gave consent to participate in the experiment. They were guaranteed that all information and results directly concerning the students would remain confidential and would be used exclusively for research purposes.

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STUDYING 3D PRINTING TECHNOLOGIES IN THE CONTEXT OF DEVELOPING INFORMATION LITERACY AMONG PROSPECTIVE SOCIAL WORKERS

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The paper deals with the use of 3D printing technologies in the professional training of prospective social workers at higher education institutions. It is noted that 3D printing could become an important tool in the professional practice of social workers. The use of such technologies will improve the efficiency and customisation of the production of a wide range of items to meet the needs of social service users. It is emphasised that items, which can be produced using 3D printing technology in the course of a social worker's duties, are in no way intended to replace professional medical or engineering solutions, but serve only as aids to facilitate the performance of basic tasks in everyday life.

***The purpose** of the article is to identify opportunities for studying 3D printing technologies as part of the training of prospective social workers, with a view to developing their information literacy. A range of **methods** was employed to achieve the set purpose. Using the method of analysis and synthesis, a review of academic publications on the research topic was conducted. The potential for incorporating 3D printing technologies into the training of prospective social workers to develop their information literacy was explored through the use of the pedagogical experiment method. The method of generalisation was employed to formulate the conclusions of the study.*

To facilitate practical use by students, a classification of items for users of social services has been proposed, based on their intended purpose. The following categories have been identified: fasteners, holders and stands; organisers and containers; adapters to facilitate the use of items by people with functional limitations; safety enhancement elements; tactile-informational and visual identifiers; and psychological relief elements. The proposed classification system for products that can be manufactured by prospective social workers whilst providing social services, in conjunction with Fused Deposition Modelling (FDM) 3D printing technology, formed the basis for the development of a separate module within the course "Information Technology in Social Work".

An experimental study was conducted on the development of 3D printing skills among prospective social workers whilst they were studying the subject. The practical component of the module on 3D printing technologies took the form of laboratory exercises carried out by students through group work. The study confirmed the value of incorporating 3D printing technologies into the curriculum for students studying for a degree in Social Work. The study suggests that mastering 3D printing skills will enable future social workers to meet users' specific individual needs by creating appropriate products.

***Conclusions.** As a result of the study, a list of categories of such items for users of social services was identified, based on their intended purpose. They were classified as follows: fasteners, holders and stands; organisers and containers; adapters to facilitate the use of items by people with functional limitations; safety devices; tactile and visual identifiers; and stress-relief aids. It was found that learning about 3D printing technologies helps to boost students' motivation to master their chosen profession, develop their creativity, and enhance their problem-solving skills in their professional practice. Group work on selecting and producing items for social service users using 3D printing technology helped to develop teamwork and communication skills.*

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