様　式　Ｃ－１９、Ｆ－１９－１、Ｚ－１９　（共通）

科学研究費助成事業　　研究成果報告書

平成　３０　年　　６　月　２８　日現在

機関番号：　２１６０２
研究種目：　基盤研究(C)（一般）
研究期間：　2015～2017
課題番号：　１５Ｋ０２７２３

研究課題名（和文）3D Printing in Creative Factory Contexts for English Language Learning

研究課題名（英文）3D Printing in Creative Factory Contexts for English Language Learning

研究代表者
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交付決定額（研究期間全体）：（直接経費）　　3,300,000円

研究成果の概要（和文）：This was a very successful project where different undergraduate project-based English courses based on 3D Printing and Design were taught. The citizens would benefit by taking part in these courses that has been designed not only to teach English in business but also design fundaments in society.

研究成果の概要（英文）：Several conferences on 3D printing and English language teaching were organized and attended, and many articles were published in international journals and conference proceedings. The research focused on soft content language integrated learning-based curriculum where students not only designed products and made decisions for design in society, they also learnt how to write technical documents and communicate effectively using emails and reports. An important context of this course involved using several software and apps such as 3D scanning, and CAD, and 3D Printers, besides LEGO software. Students could both play around with the software and learn it, and also write about such tools and design decisions. An English course like this is rather unique and provides a wide ranging opportunity to learn community design, the economics of how 3D printing is used, and technical English. This project also enabled an international collaboration with a premier German university.

研究分野：　Technical Communication

キーワード：　Design　3D Printing　CLIL　Projects　Technical Writing

１．研究開始当初の背景

Background of the Beginning of Research

The research project started in 2015 and was motivated by research in soft content language integrated learning (CLIL) pedagogy.

２．研究の目的

Purpose of the Study

The purpose of the study was to understand how a creative factory styled pedagogical genre involving 3D printing processes could be used in a foreign language-teaching classroom.

３．研究の方法

Method of Research

This was a very successful project where different undergraduate project-based English courses based on 3D Printing and Design were designed, taught, and student performance evaluated extensively. A mixed method (both quantitative and qualitative) approach was adopted, including usability-based observational and note-taking techniques. Further, this course involved survey design on 3D Printing practices by students, and data collection from both undergraduate and graduate students at the University of Aizu.

４．研究成果

Research Results

Results indicated students were able to understand the processes and document the projects in English successfully. The process of technical documentation techniques could be successfully taught. Several conferences on 3D printing and English language teaching were organized and attended, and many articles were published in international journals and conference proceedings.

The research focused on soft content language integrated learning (CLIL)-based curriculum where students not only designed products and made decisions for community design in society, they also learnt how to write technical documents and communicate effectively using emails and various reports. An important context of this project-based courses involved using several software and apps such as 3D scanning, and CAD, and 3D Printers, besides LEGO software. Students could both play around with the software and learn it, and also write about such tools and design decisions. An English course like this is rather unique and provides a wide-ranging opportunity to learn community design, the economics of how 3D printing is used, and technical English. The most significant result from this approach to the project is the fact that this was just not another English language course. These were courses where students learnt project management and design and developed decision-making abilities through a process of group consultation and negotiation.

This project also initiated an international collaboration with a premier German university. As part of this project, a joint collaborative course would be taught both at the undergraduate and graduate level with Karlsruhe University of Applied Sciences. The students at the University of Aizu would design content on 3D Printing processes using multiple documentation and design software, including extensive technical writing documents. The KUAS students would then visit the University of Aizu to work jointly with our students towards developing content management and delivery systems to facilitate robust search criteria for the information used in the projects. Such projects would help students get engaged in wide-ranging communication and decision-making with our students.

As part of this project, an ACM-Chapter 3D Printing international conference was held in Rensselaer Polytechnic Institute, New York, and another ACM Chapter conference on 3D Printing has been planned for February 2019. Such conferences bring in a unique perspective to project-based content integrated language learning and communication. In a Japanese context, such attempts are very unique and never been tried earlier. Such an approach enables a robust and wide-ranging understanding of the field, and promotes entrepreneurial abilities through networking and presentations at premier conferences.

This project also helped shape an understanding of how globalization could be initiated in Japanese universities through such international and collaborative project-based ideas in language classes.

This project resulted in many publications over the last three years, and in future, this soft CLIL approach would be highlighted and extensively dealt with in English language courses dealing with entrepreneurship and globalization in a 3D Printing and design-related context.

５．主な発表論文
（研究代表者、研究分担者及び連携研究者には下線）

Publications

Roy, D. (2018). Understanding the Value of Website Design and Analysis in a Comprehensive CALL Environment. Handbook of Research on Integrating Technology into Contemporary Language Learning and Teaching, 86. IGI Global.

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Roy, D. (2017). Content areas in 3D Printing-based Language Teaching with Technical Writing Focus. *Proceedings of the JTCA Annual Symposium*, Tokyo, 76- 83.

Roy, D. (2017). Developing a project-based CALL environment with technical communication in an exploratory 3D printing context. International Journal of Computer Assisted Language Learning and Teaching, 7 (2), 75-101.
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Roy, D., & Crabbe, S. (2017). 3D printing with critical thinking and systems design: an innovative approach to task-based language teaching in technical communication. In J. Colpaert (Ed.), CALL 2017 Proceedings (pp. 650-657), University of California, Berkeley, San Francisco, USA. (Proceedings pg. 650-657).

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Roy, D. (2017). Using Design Pedagogy with LEGO and CAD Software in a Task-based English as Foreign Language Teaching Context. Proceedings of the INTED 2017 International Conference, Valencia, Spain. (Proceedings pg. 1042-1050).

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Roy, D. (2016). 3D Printing-based Initiatives in a Developing Economy Context: A Holistic Approach. Proceedings of the IEEE-ACM Chapter ICIIT Conference, Colombo, Sri Lanka.

Roy, D. (2016). Task-based Technical Communication with 3D Printing-based Initiatives in a Foreign Language Teaching Context. Proceedings of the Annual JTCA Symposium, Kyoto, Japan, October 8-10.

Roy, D. and Yasuta, T. (2016). **外国語教育における３Dプリンティングベースのプログラムを用いたタスクベースステクニカルコミュニケーション**. Proceedings of the Annual JTCA Symposium, Kyoto, Japan, October 8-10.

Roy, D. (2015). Design Education in Creative Factory Contexts for Task-based English Language Learning. Proceedings of the Annual JTCA Symposium, Kyoto, Japan, October 8-10.

Roy, D and Katsuko, K. (2015). **タスクベース英語学習を目的とした創造的制作環境におけるデザイン教育**.Proceedings of the Annual JTCA Symposium, Kyoto, Japan, October 8-10.

Journal Articles (Total): 2
Conference Proceedings (Total): 13
Book Chapters: 1

6. 研究組織

Research organization

(1) Research Representative: Debopriyo Roy

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